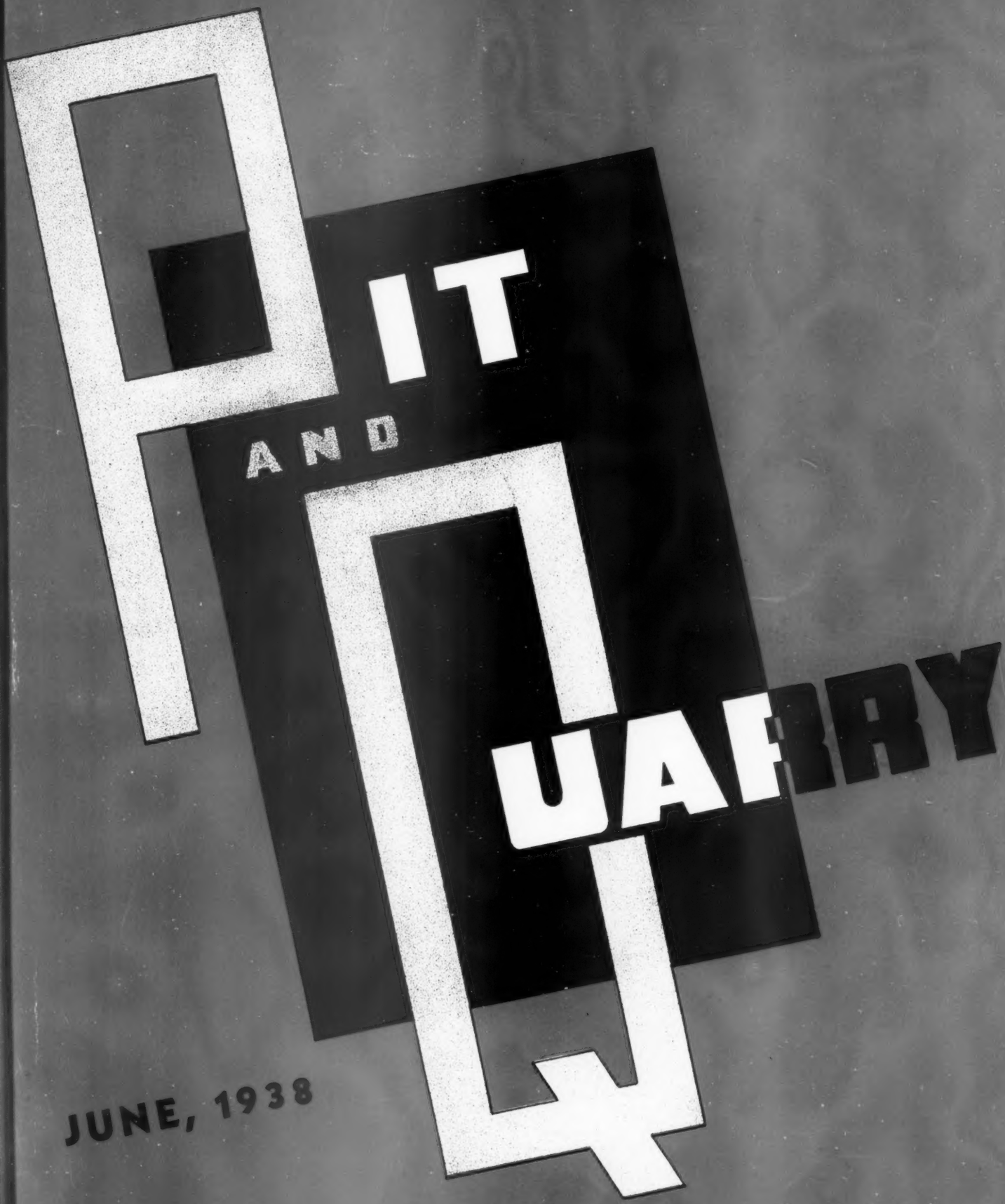


JUNE, 1938

CONVENTION ISSUE ..... National Lime Association
National Industrial Sand Association

MOTORS GEARED DIRECT TO THE JOB *bring* SIX SAVINGS

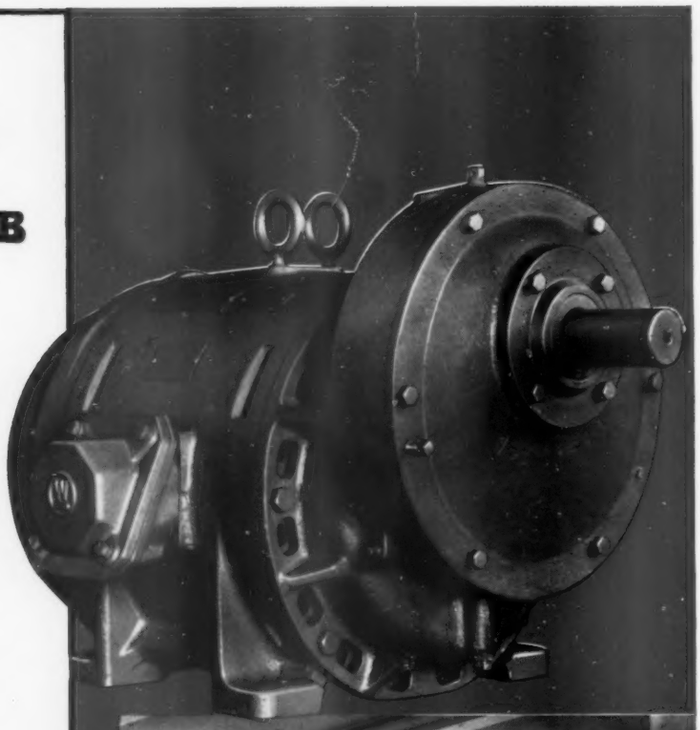
Developed to meet today's demands for production economy, gearmotors may be installed and forgotten except for normal maintenance and occasional oil.

Investigate geared drives for your production line. They offer six substantial savings:

1 Save power in transmission
2 Save shutdowns
3 Save accidents
4 Save in installation cost
5 Save maintenance
6 Save space

For complete information, consult Westinghouse—not only leaders in perfecting the electric motor, but also builders of precision gears for over 50 years. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

J 07086



Geared drive solves cold weather starting problem for this cement mill.

Westinghouse Gearmotors are selected for the tough jobs—this geared drive gives trouble-free service in spite of exposure to abrasive dust.

WESTINGHOUSE ELECTRIC

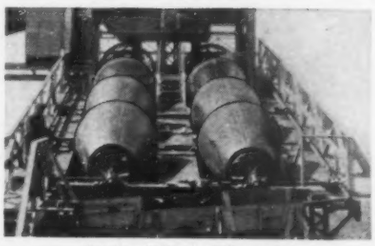
Westinghouse *Geared Drives*

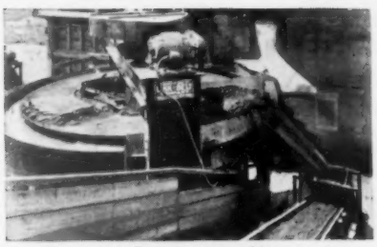
GEARMOTORS · SPEED REDUCERS · GEARING

● Profit by the ideas gained from thousands of practical cost-cutting installations handling every conceivable kind of material and employing all types of conveying and power transmitting equipment.

● Link-Belt makes them all, and recommends and applies each where it serves best. General Catalog No. 700 contains 1248 pages of engineering data. Send for your copy. Address the nearest office.

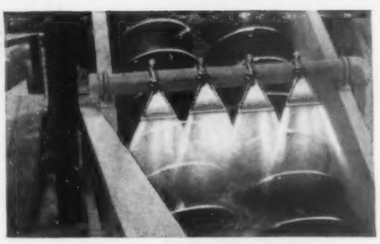
LINK-BELT
Preparation Equipment


Inclined Conical Screens


Rotoscoop for recovery of fine sand

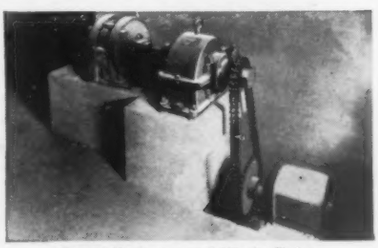
Belt Conveyor handling sand

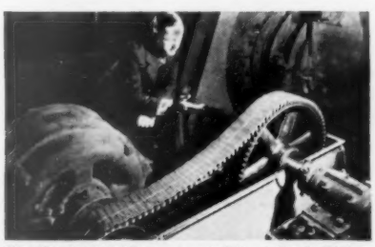
Conveyors • Positive Drives
and Power Transmission Equipment

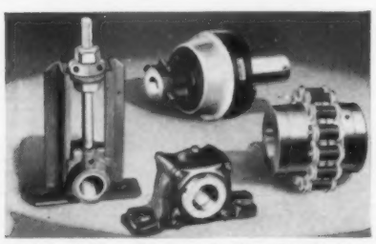

Dewatering Screw Conveyors

Self-Aligning Belt Conveyor Idler

Steel Apron Conveyor handling rock


Speed Reducer and Chain Drive


The Link-Belt Silverstreak Silent Chain Drive


Bearings, Collars, Hangers, Pulleys, Take-ups, etc.

Send for 1248-page Engineering Data Book No. 700. Address nearest office.

LINK-BELT COMPANY

The Leading Manufacturer of Equipment for Handling Materials and Transmitting Power 7326B

CHICAGO Plant, 300 W. Pershing Rd. CHICAGO, Caldwell-Moore Plant, 2410 W. 18th St. INDIANAPOLIS, Ewart Plant, 220 S. Belmont Ave.
PHILADELPHIA Plant, 2045 Hunting Park Ave. INDIANAPOLIS, Dodge Plant, 519 N. Holmes Ave. SAN FRANCISCO Plant, 400 Paul Ave.
ATLANTA Plant, 1116 Murphy Ave., S. W. *Offices in Principal Cities* In Canada—Link-Belt Limited—Toronto Plant; Montreal; Vancouver

PIT AND QUARRY, June, 1938. Vol. 30, No. 12. Published monthly by the Complete Service Publishing Company, 538 South Clark Street, Chicago, Ill. Subscription price $1 for 1 year in the U. S. and possessions, Canada, Central and South America; elsewhere $1 additional for each year. Single copies 20 cents. Entered as second-class matter February 28, 1932, at the Post-Office at Chicago, Ill., under the act of March 3, 1897.

STEP ON IT, MARY.... I've got to be there early to get a CLEVELAND!

Time and again word has come to us that the men are going to work early to be sure of getting a Cleveland, rather than some other drill that might be available. It is a well-known fact that Cleveland Drills turn out a lot of footage in a day—that they are easy to hold—handy to control—that they give less trouble, use less air—that they are generally more satisfactory alike to operator and owner.

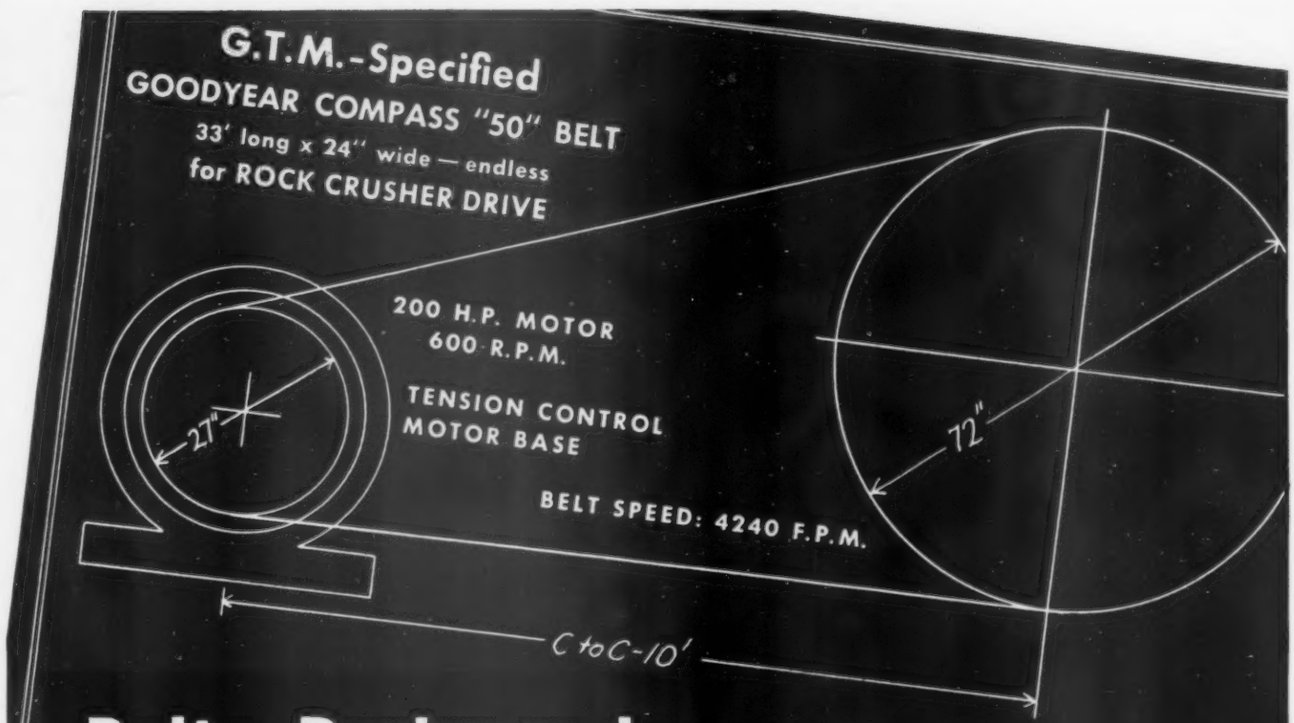
It's no wonder, then, that Mike wants to be early to work, and that Mary has to "step on it," thus doing her part in making sure Mike gets the drill he knows he can turn out the footage with. Your men, too, will like Clevelands. And you will want no other make when once you have had these fast, efficient machines on your job. Demonstrated any time, anywhere. Let us send the new Bulletin 122.

THE CLEVELAND ROCK DRILL COMPANY

3734 EAST 78TH STREET • CLEVELAND, OHIO

Cable Address: ROCKDRILL

LEADERS IN DRILLING EQUIPMENT



Belts Broke and BROKE and BROKE

UNTIL THEY CALLED IN THE GTM

THE crusher in a busy southwestern crushed rock plant is loaded directly from dump cars—five cubic feet at a time. Under this shock load the heaviest 7-ply belts broke whenever the crusher jammed—as frequently happened—making it necessary to repair the belt and clean out the crusher before resuming operations. As a result much time was being lost.

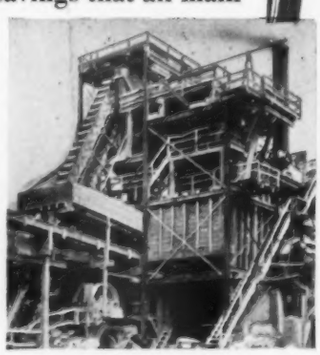
But the last straw was the breaking of the motor shaft under an especially heavy load one morning. The plant superintendent sent out an S. O. S. for the G.T.M.—Goodyear Technical Man.

Discovering that this drive was overloaded as much as 50% at times, the G.T.M. recommended that the motor be mounted on a tension control base and that the drive be fitted with a Goodyear COMPASS "50" truly endless belt. This was done in April 1936.

Not a shutdown in two years

In the two years the COMPASS has been on the job there has never been a shutdown for belt repair—not even to cut out stretch because the COMPASS hasn't stretched! Jams have disappeared—because the COMPASS starts up under the heaviest loads and grinds the crusher empty.

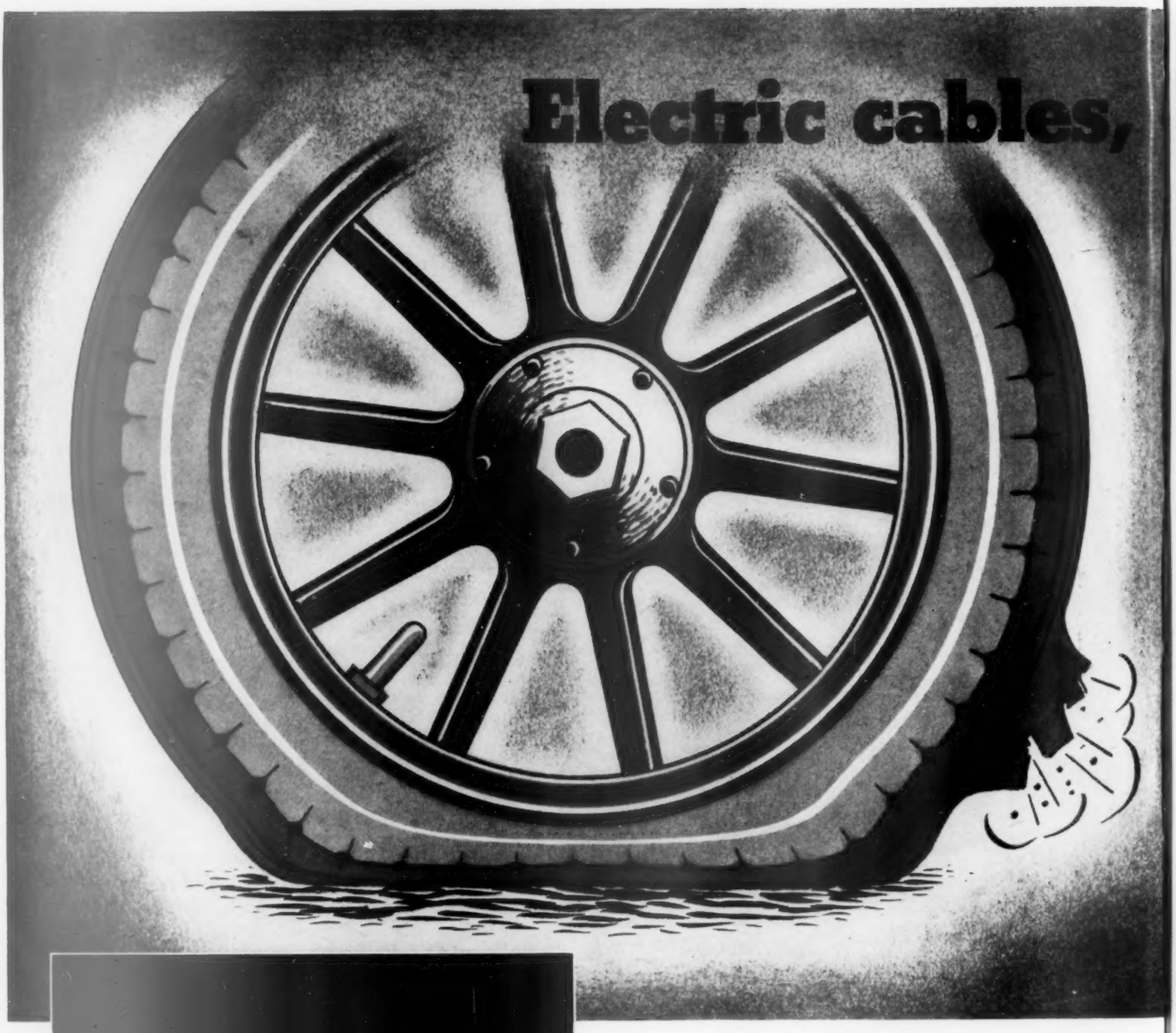
So great have been the savings that all main drives in this plant are now equipped with Goodyear COMPASS Endless Belts. If you have a belt-breaking drive, why not consult the G.T.M. Just write Goodyear, Akron, O., or Los Angeles, Calif.—or call the nearest Goodyear Mechanical Rubber Goods Distributor.



BELTS
MOLDED GOODS
HOSE
PACKING
Made by the makers of Goodyear Tires

THE GREATEST NAME IN RUBBER

GOODYEAR



Anaconda Duraseal
used as main primary feeder

Chosen because of ability to resist abrasion and withstand direct contact with mine floor

In a mine of the Detroit Rock Salt Company, Anaconda Duraseal Type D was chosen as a main primary feeder for the substation because of its uncanny ability to resist abrasion and to withstand direct contact with the salt floor of the mine. Duraseal is a non-metallic sheathed cable, with a remarkable record in difficult service—because of the effectiveness of the sheath against mechanical damage and organisms causing mold and rot. It forms a durable seal over the insulated conductors—hence its name, Duraseal. A natural for service in mines and similar locations. Write for Publication C-27 describing Duraseal — a typical example of Anaconda cable research.

USE MODERN IMPROVED *Anaconda Wire*

ANACONDA WIRE & CABLE CO., General Offices: 25 Broadway, New York

Subsidiary of Anaconda Copper Mining Company

like tires, have improved!

You don't ride on "1911 model" tires ... neither should you use wires and cables of that same vintage. They're too expensive to use today!

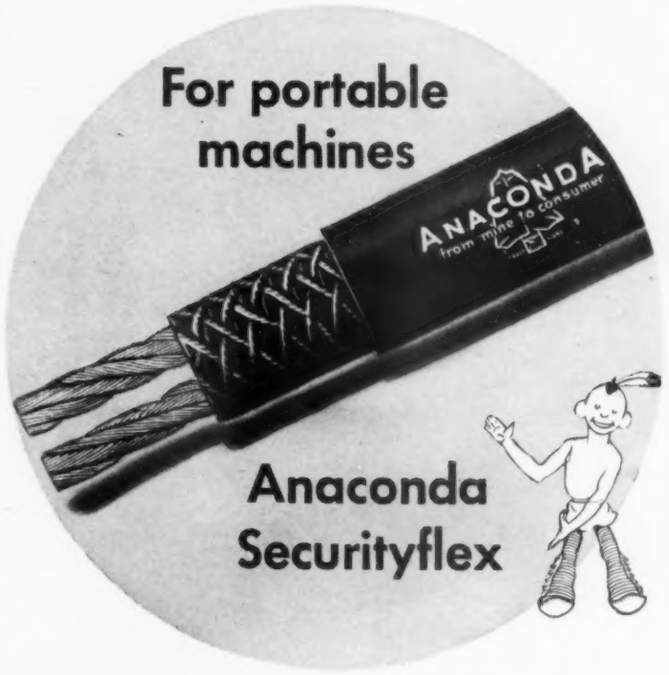
REMEMBER how punctures and blow-outs took the joy out of motoring in the early days? Certainly nobody could sell you "1911 model" tires today. Electric cables, too, have been improved and perfected—just as tires have been. In this development of better cables, Anaconda research has played an important part.

Specify Anaconda—save money

Our engineers have developed new and interesting insulations, more effective saturants and finishes—in a word, have *built in quality* that means better value for cable users. Shown at the right is Securityflex—one example of a better cable born of Anaconda research. At the left is Duraseal—another Anaconda cable that saves money for users. These are but two of many modern cable developments by Anaconda.

Use our advisory service

Our staff engineers are prepared to give immediate assistance to engineers having difficult or unusual problems in the design or application of wire and cable. Their services are available at all times to assist in the solution of technical wire problems, or in the development of special cables. 38455



Toughest mine cable you can buy

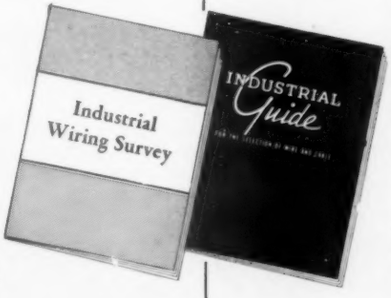
Here is a cable jacketed with a covering like today's automobile tire. The sheath is 60% mold-cured rubber. There is as much difference between Anaconda Securityflex and old-fashioned cable as between the modern automobile tire and that of the early days.

Mining companies use Anaconda Securityflex on movable equipment such as loaders, cutters, conveyors, drills and locomotives. The high-grade rubber insulation on the individual conductors assures electrical safety. Pick this cable for your most severe operating conditions. Securityflex will last longer, stand more abuse, and in every way deliver more for your money. Get the full story ... ask for Catalog No. 351.

ANACONDA
from mine to consumer

& Cable

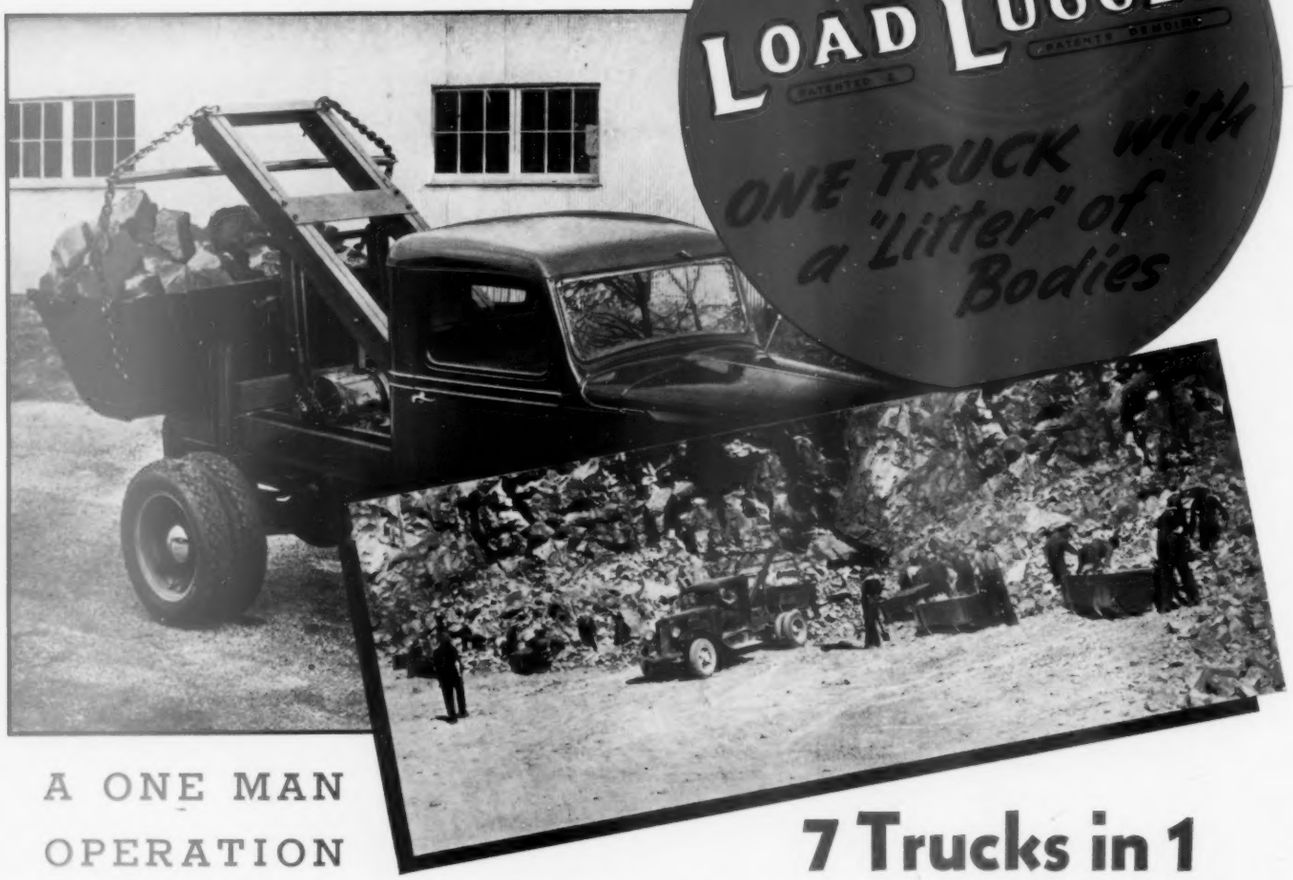
Chicago Office: 20 North Wacker Drive
Sales Offices in Principal Cities



Costly Breakdowns can be avoided

If your shovels cost thousands of dollars and an expensive crushing plant depends on the output, an hour's delay due to cable failures is costly. Shovels develop a big voltage load, with DEMAND surges which will burn out any cable unless it is of adequate size. In many lines of industry, management finds a check-up on electric circuits cheap insurance against expensive breakdowns. Anaconda will collaborate with your electrical engineer, superintendent or electrical contractor in making a complete check-up of your electrical wiring. Why not get in touch with us? As the first step, get these books which outline a tested method of making an industrial wiring survey. They will be sent free.

The NEW Low Cost Method of Hauling and Dumping—



A ONE MAN OPERATION

With a single minor exception—hooking the bucket chains before raising load—the Brooks Load Lugger is a one man operation from driver's seat. The one piece, sturdy buckets are carried on the truck itself, with no counter-weights required . . . no suspended load . . . no side swing, and dumped instantly and automatically. Built in 4 capacities . . . one of which will fit your requirements.

7 Trucks in 1

Never before, we believe, has a piece of equipment been produced to equal the Load Lugger, in its field, for production economy. It is practically fool-proof in operation, and mountable on any truck chassis in a few hours. No sheaves, cables, high-pressure hydraulic hose or "gagets" are used . . . and consequently no costly replacements. The Load Lugger has a direct drive from power to take-off to Hydraulic Pump Hoist, and which, is positive in both up or down motions.

The amazing possibilities of the Brooks Load Lugger in cutting, hauling and dumping costs are almost unbelievable. Yet, wherever loading is done by hand, one truck and 5 to 10 Load Lugger buckets may replace an equal number of trucks, depending, to some extent, upon the distance of the haul.

Cash in on the Brooks Load Lugger at once. Write or wire for complete details. Demonstrations arranged.

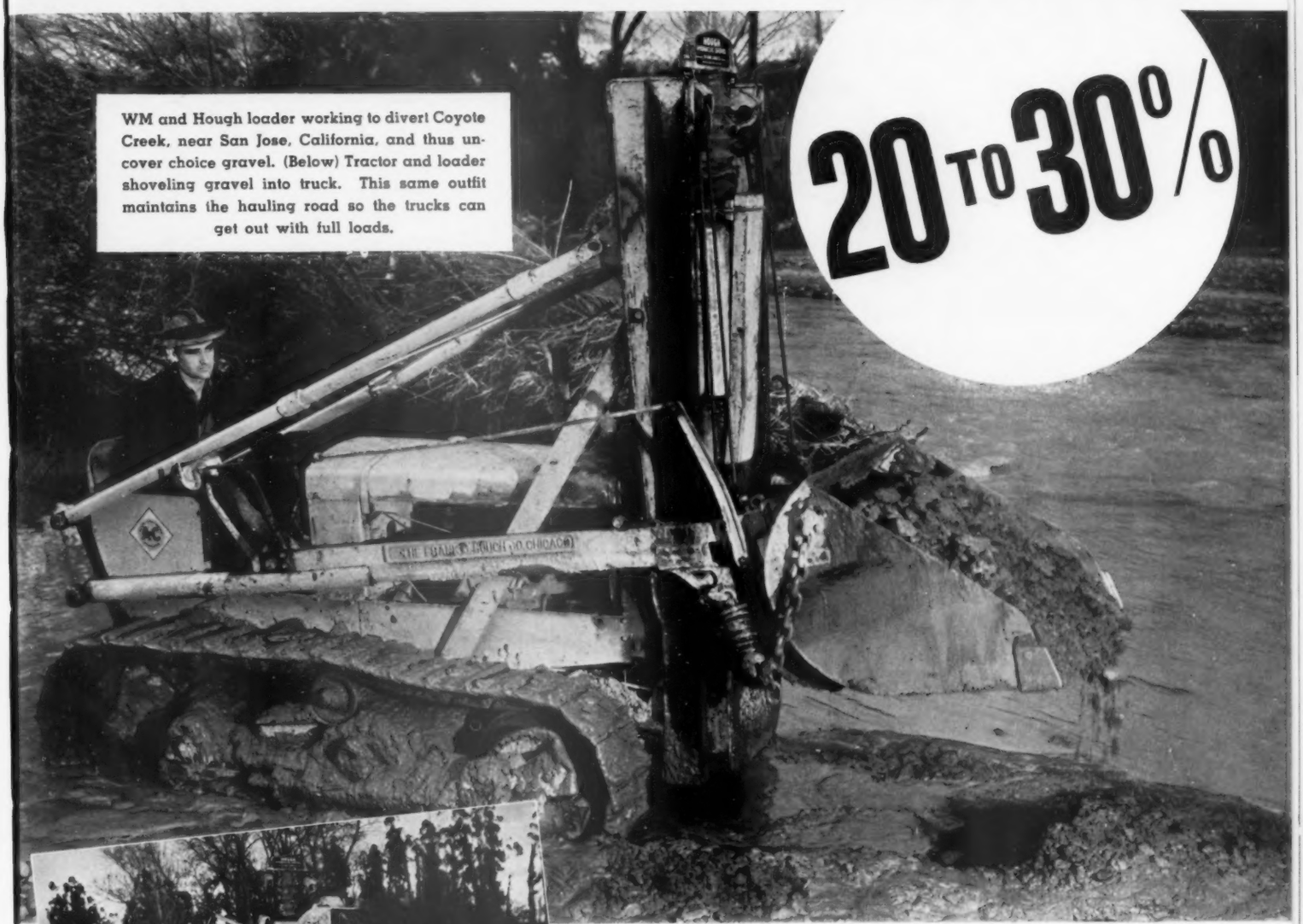
BROOKS EQUIPMENT AND MFG. CO.
KNOXVILLE • TENNESSEE

Manufacturers of the nationally known DAY "Jaw-Type" Rock Crushers, DAY "Swing-Hammer" Crushers or Pulverizers. A complete line for any desired capacity.

You Can't Go Wrong in a "DAY"

PRINT IN B

SPEEDS UP LOADING OPERATIONS



WM and Hough loader working to divert Coyote Creek, near San Jose, California, and thus uncover choice gravel. (Below) Tractor and loader shoveling gravel into truck. This same outfit maintains the hauling road so the trucks can get out with full loads.

20 TO 30%

That's what E. H. Cunningham, West Coast owner, says of his Model WM tractor and Hough loader, shown here. This outfit built a road into the job, dug a new channel to divert a creek from choice gravel deposits, then shoveled the gravel into trucks for hauling. In 800 hours of operation neither tractor nor loader have been laid up for repairs, never lost a day's work. Like Cunningham, you can cut your loading costs with a WM tractor and Hough loader . . . in addition build and maintain your hauling ramps and roads, do light stripping, stockpile material, etc. Can be easily and quickly towed from one gravel pit to another on its own transport wheels. Drawbar is always free for pulling. Ask your nearest Allis-Chalmers dealer to show you how this fast-moving outfit can cut your aggregate costs.

asoline and Controlled Ignition Oil Track-Type
ractors from 32 to 80 Drawbar H. P. . . . Tandem
nd Single Drive Speed Patrols . . . Drawn Blade
raders . . . Industrial Wheel Tractors . . . Stationary
ower Units from 31 to 102 Brake H.P. . . . two, four
nd six-wheel scrapers, bulldozers, trailbuilders,
aders, winches and other allied equipment.

ALLIS-CHALMERS

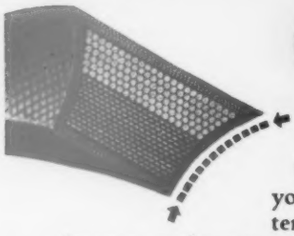
TRACTOR DIVISION—MILWAUKEE, U. S. A.

NT IN BINDING

Here is Plain Proof

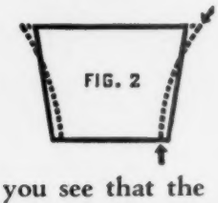
that V-Belts NEED the

Concave Side



Bend any V-belt and here is what you will notice: The top is under tension and becomes narrower. The bottom, under compression, *widens*. These stresses distort a *straight-sided* V-belt into a shape that does not fit the sheave groove—as shown in Figure 1, below. Note the out-bulge of the sides.

WHAT HAPPENS WHEN A V-BELT BENDS



Now look at Figure 2. Here you see that the same *shape change* merely *straightens* the precisely engineered concave side. There is no side-bulge. *Two* savings result: 1. You get *uniform* side-wall wear, *longer life!* 2. The full side-wall grip on the pulley insures against slippage on sudden load increases—a saving both in belts and *power*.

The Gates Vulco Rope is the only V-Belt built with the patented concave side.

Engineering Offices and Stocks in All Large Industrial Centers.

THE GATES RUBBER COMPANY

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GATES VULCO ROPE DRIVES

"Gravy" from Gravel

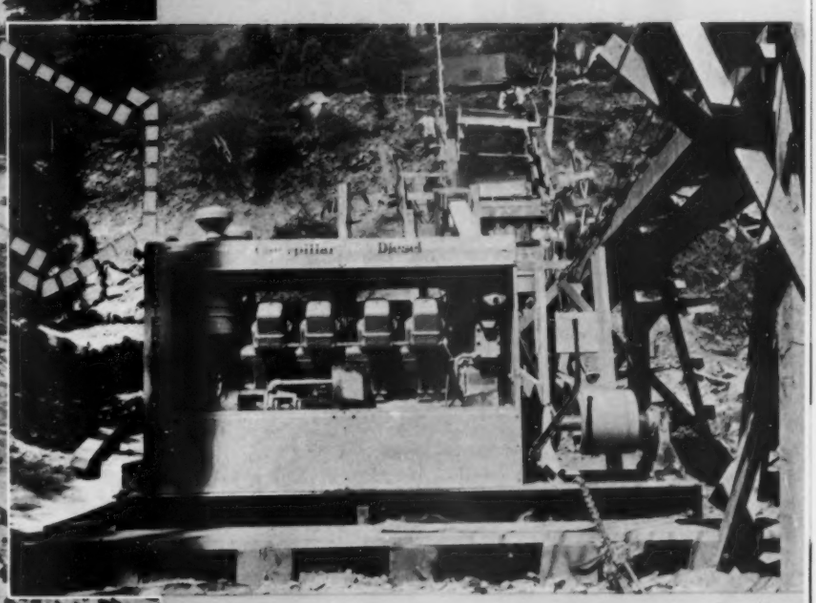
The $11 per day which this 160-horsepower "Caterpillar" Diesel Engine saves for its owners, as compared with the type of power formerly used, is clear gain — extra profit — pure "gravy." The engine drives a Traylor rock crusher turning out 100 to 150 tons of rock per hour. Location, near Hobart Mills, Calif.

On many all-season jobs, $11 a day can reasonably bring the saving to $250 a month, or $3000 a year. And that's good "gravy" in any language — on any kind of contract work! It's easy to figure how quickly an outfit can pay for itself on such a basis.

But that isn't all . . . the owners of the above-mentioned plant enjoy still further "Caterpillar" Diesel economies — through the use of a "Caterpillar" track-type Tractor, a "Caterpillar"-powered Link Belt shovel, and a No. 10 "Caterpillar" Auto Patrol.

With "Caterpillar" Diesel Engines running up records of thousands of hours of trouble-free performance and unusually low operating costs, progressive pit-and-quarry men are no longer debating the wisdom of changing over from other types of power. The procedure is simple: See your nearest "Caterpillar" dealer or any leading manufacturer of the powered equipment in which you are interested — and ask for "Caterpillar" Diesel power. *Nine engine sizes — 32 to 160 horsepower.*

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS



CATERPILLAR

REG. U.S. PAT. OFF.

DIESEL POWER

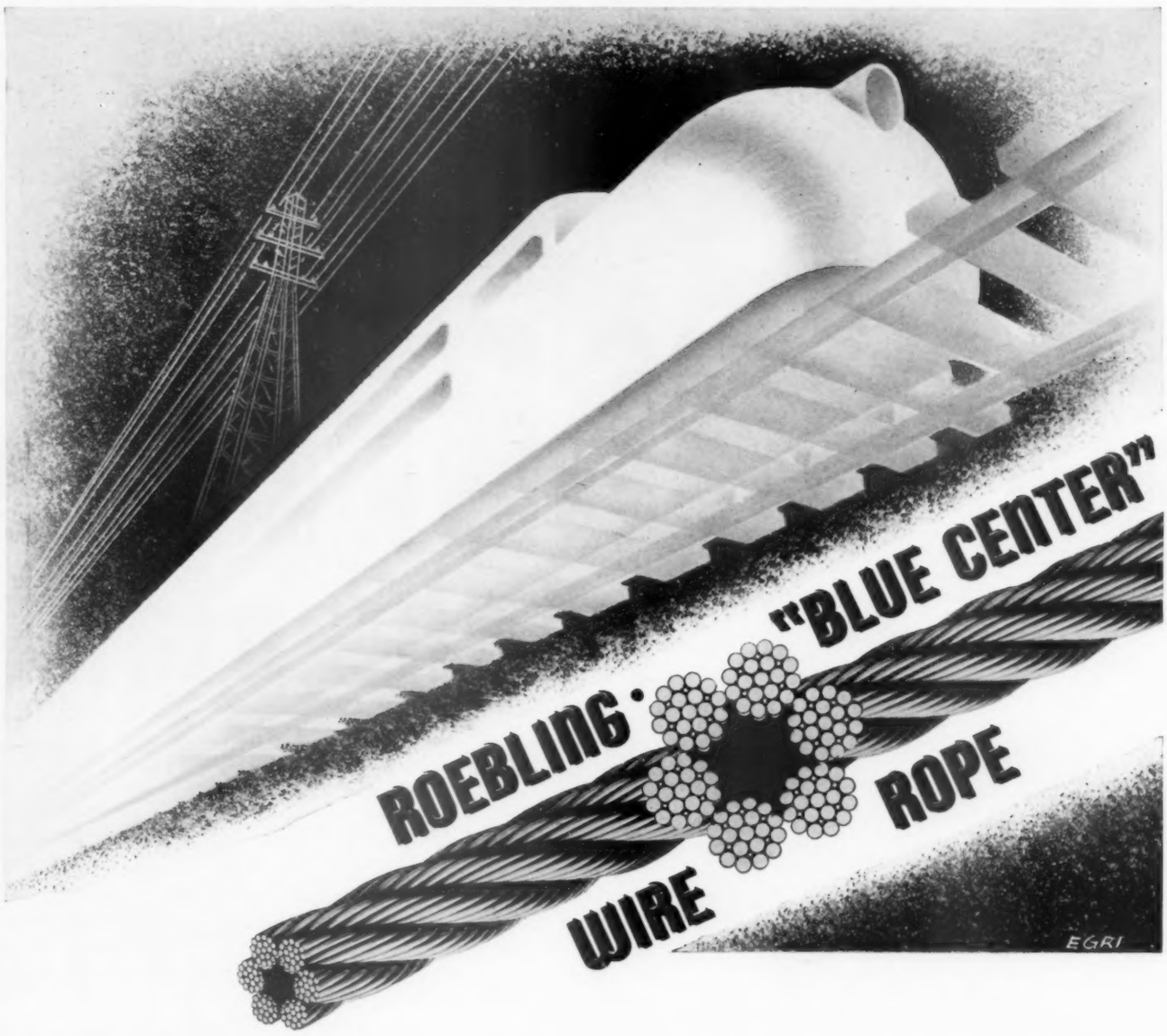
DIESEL ENGINES • TRACK-TYPE TRACTORS • ROAD MACHINERY

KOEHRING

SPEED FOR PROFIT— cut rock and dirt-moving costs by the use of high speed equipment. Koehring Excavators and Dumptors increase production due to the maximum flexibility and high operating speeds. Easy and close-up Dumptor spotting reduces shovel swing time. Quick get-away reduces shovel waiting time. High speed excavating requires high speed dirt-moving units for maximum possible profit.

KOEHRING COMPANY
CONSTRUCTION EQUIPMENT • MILWAUKEE, WISCONSIN

AS ADVANCED AS TODAY'S STREAMLINERS!



The highest achievement of the Roebling organization . . . of its unexcelled research and manufacturing facilities . . . and over ninety years of rope making experience!

•

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

BRANCHES IN PRINCIPAL CITIES

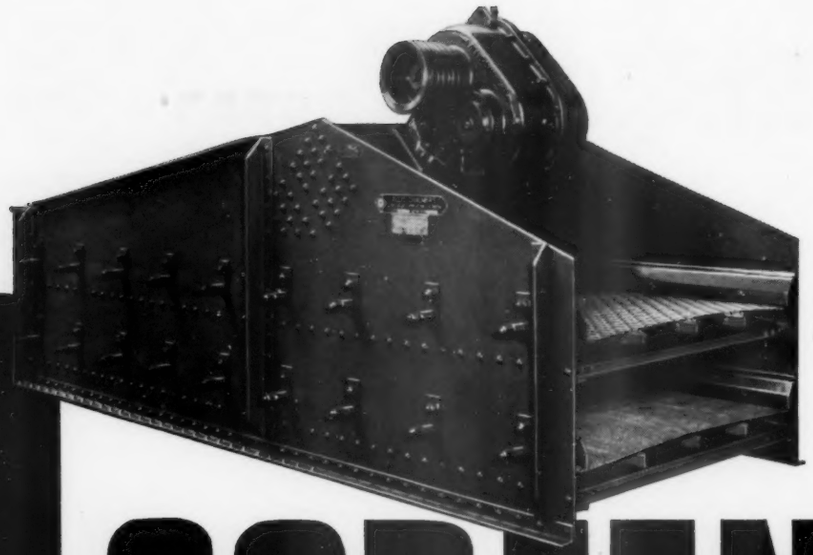
STRONGER—Wire of highest strength consistent with ductility and toughness

TOUGHER—Provides maximum resistance against wear, sudden shocks, vibration

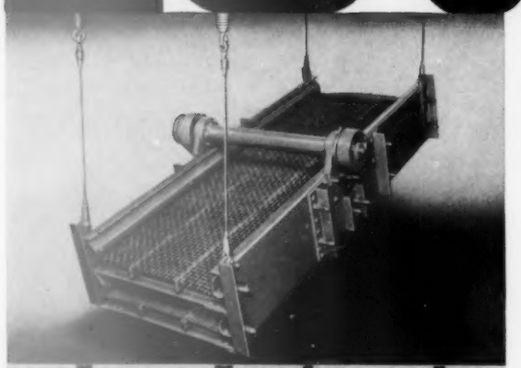
SAFER—Unequalled for uniformity of quality

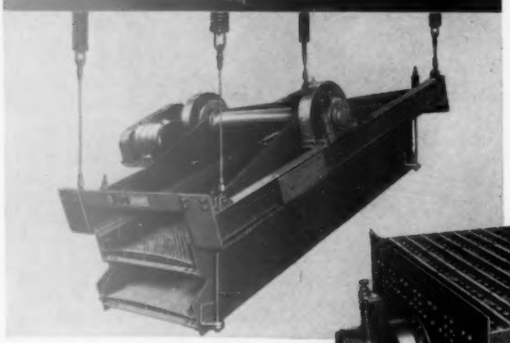
SAVING—Insures lowest general average operating cost

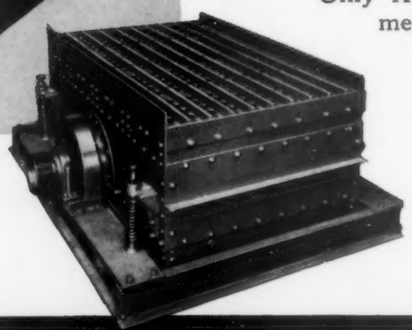
THE HIGHEST DEVELOPMENT IN ROEBLING WIRE ROPE



19 SCREENS in one plant







AND EVERY ONE CUTTING PRODUCTION COSTS!

No one screen can handle all sizing jobs. You can't keep costs down, unless each screen pays its way — doing the work for which it was built.

That's what a prominent automobile manufacturer found. Now, on the recommendation of Allis-Chalmers engineers, he's cutting production costs with four distinct, basic types of screen! Actually, there are 19 Allis-Chalmers screens, performing many services, in his plant.

Only Allis-Chalmers can make an impartial recommendation to you on screening problems. For Allis-Chalmers alone builds eight types of screen, each designed to do a particular type of job efficiently and economically.

And there's no screening problem, large or small, that can't be solved by Allis-Chalmers engineers. They're ready to put a wealth of technical experience to work to help you on cutting your costs!

928

ELECTRICAL AND MECHANICAL VIBRATING SCREENS • ROTATING SCREENS • STATIONARY AND ACTIVATED GRIZZLIES • CRUSHING, WASHING, AND METALLURGICAL MACHINERY

CRUSHING · CEMENT AND MINING DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

Swintek LADDERS ARE PAYING BIG DIVIDENDS

3 — HUGE LADDERS SHIPPED SINCE JAN. 1st

BEDFORD NUGENT CO., EVANSVILLE, IND.
70 FT. LADDER, 12 IN. PIPE LINE (THEIR SECOND MACHINE)

STURM & DILLARD CO., SYRACUSE, IND., CIRCLEVILLE PLANT
65 FT. LADDER, 15 IN. PIPE LINE (THEIR SECOND MACHINE)

MISSOURI PORTLAND CEMENT CO., ST. LOUIS, MO., MEMPHIS PLANT
65 FT. LADDER, 15 IN. PIPE LINE

LET US MAKE DIVIDENDS FOR YOU

INVESTIGATE!

CONSULT US ABOUT YOUR
WASHING PROBLEMS

EAGLE IRON WORKS
DES MOINES, IOWA, U. S. A.

No Wonder they Prefer CONTINENTALS

Continentals get the load over the edge! This 7-yarder is handling 8-yard loads of loose dirt on a highway relocation job.

Right: A 10-yarder posed to show why Continentals dig faster, fuller loads—the entire weight of the scraper, plus the full power of the tractor, is exerted on the blade!

Continentals move dirt faster with less power and at a lower cost than any other dirt moving equipment made. They do things no other wagon scraper *can do—back-dumping over the edge of a fill without the need for bulldozing; digging with the full weight of the scraper on the blade; backing without zig-zagging.* Every operation — digging, back-dumping, spreading, grading or windrow dumping — requires a minimum of tractor power and is hydraulically controlled. Operation is as simple as turning a faucet.

For bigger loads, more trips per day, less maintenance and greater earnings, get the wagon scrapers that operators prefer—*Continentals.*

Made in 4, 5, 7 and 10 yard sizes on low pressure tires or mounted on crawlers. Sold and serviced by Allis-Chalmers dealers everywhere.

CONTINENTAL ROLL & STEEL FOUNDRY COMPANY
Tractor Equipment Division
14400 Railroad Avenue
EAST CHICAGO, INDIANA

TYPICAL PRAISE from USERS:

(Excerpts of letters taken from our files.)

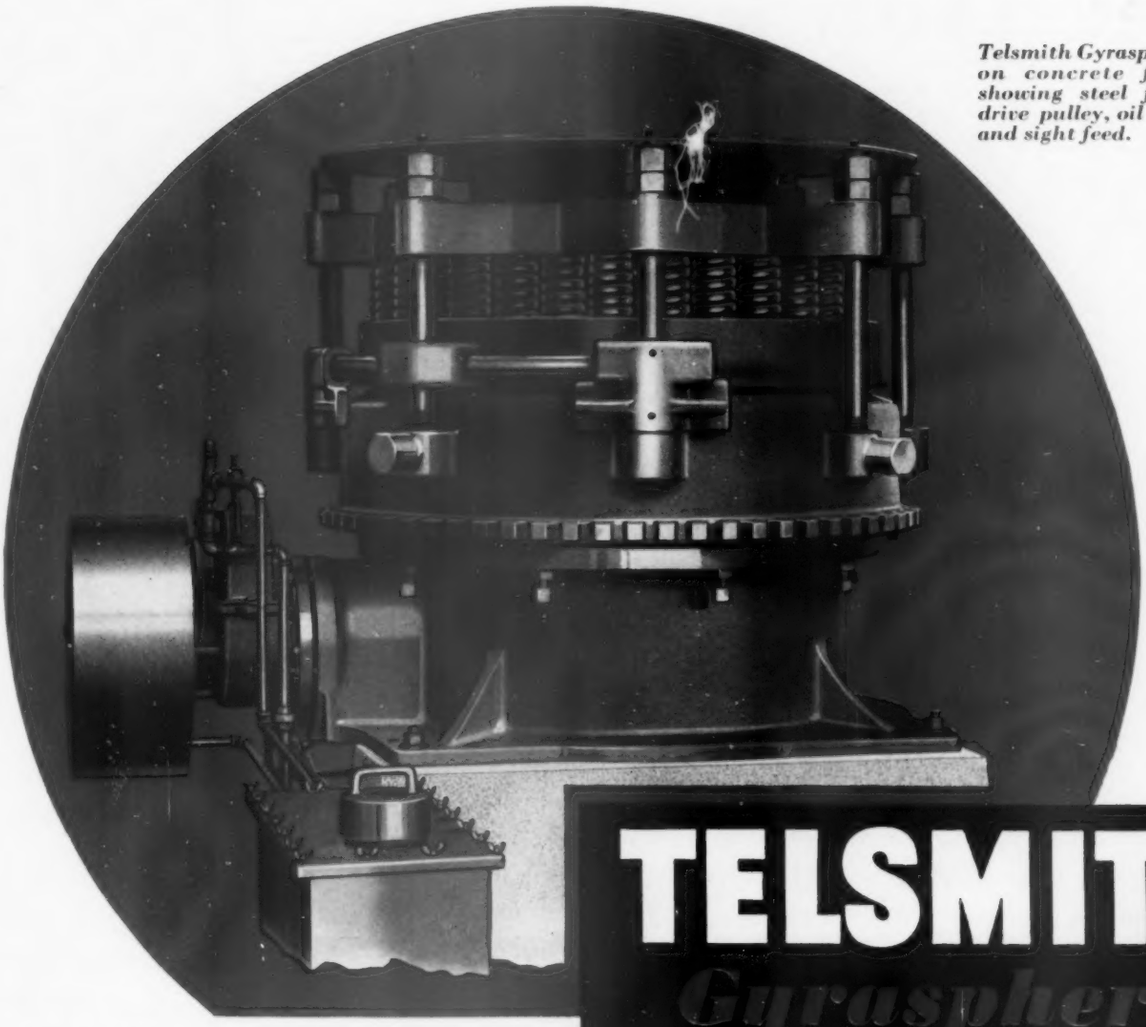
"The money-makingest dirt mover we've ever owned. We can bid lower and still make more. From now on, it's Continentals exclusively for us!"

"Continentals work while other dirt moving outfits sleep. They get more done on straight hauls and eliminate bulldozing for us."

"We'd be paying through the nose if we hadn't investigated Continentals before buying. You didn't overrate them a bit."

"They hog up gumbo, sand, wet clay, imbedded roots and rocks just like you'd take a dipper full of water—never saw anything like it. Wish our old-fashioned four-wheel rigs could work like Continentals."

CONTINENTAL WAGON SCRAPERS



Telsmith Gyrasphere Crusher on concrete foundation, showing steel feed hopper, drive pulley, oil tank, piping and sight feed.

TELSMITH *Gyrasphere* CRUSHERS

GREATER TONNAGE . . . . .
MORE CUBICAL PRODUCT . .
FINER CRUSHING . . . . . .

with less trouble . . . less power . . . less upkeep

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When it comes to crushing, the Gyrasphere doesn't "crack down" on the rock. It *thrusts up.* The spherical head and its corresponding concave are like an *inverted* mortar and pestle. Rock is caught between two multi-curved surfaces—and *cubed.* That means an improved product with fewer oversize slabs and splinters.

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If you are listed in the Directory Section of Pit and Quarry Handbook, you already own a copy. Make use of it frequently. Study it at every opportunity . . . you are bound to learn something new that will help you in the production end of your business. Whenever an operating problem comes up, turn first to the Handbook. You'll probably find a solution. Consult its Buyers' Guide when you want a specific piece of equipment. Turn to the Index of Trade Names to find out who manufactures a certain machine.

If you are a producer of aggregates, cement, lime, gypsum or other nonmetallic minerals and do not own a copy of the newest edition of Pit and Quarry Handbook . . . you can get one . . . FREE. Just write to the address below on your company letterhead. We will send you blanks asking for information about your company for Directory-Section listing in the next edition of the Handbook. And on receipt of these properly filled in we will send you a copy of the present edition without cost or obligation on your part.

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WHAT OTHER OPERATORS THINK OF THE HANDBOOK

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•

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•

...we use it, when it is necessary to revamp one of our departments in selecting the latest methods of manufacturing.—**(Lime)**

•

...we refer to it frequently for cost data, engineering and general information.—**(Stone and lime)**

•

...used regularly for all kinds of information regarding new equipment and engineering methods.—**(Cement)**

•

...we find this book helpful in constructing plants and setting up new equipment.—**(Sand and gravel)**

•

...of much assistance in keeping posted on up-to-date methods.—**(Lime rock)**

•

...refer to it often for information and to compare equipment made by different manufacturers.—**(Silica)**

•

...so many suggestions concerning plant design, plant operation and practical economies which we refer to constantly.—**(Sand and gravel)**

•

...encountering plant difficulties, our first thought is to refer to the Handbook and we are usually successful in finding a solution to our trouble. —**(Limestone products)**

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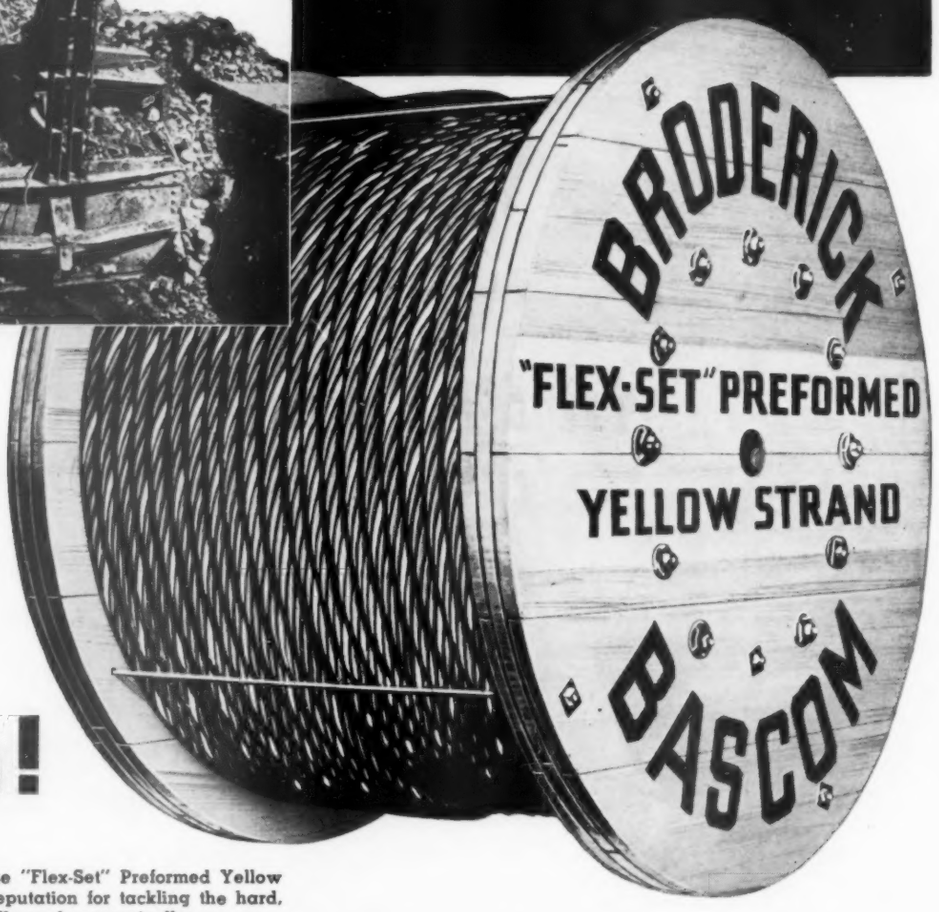

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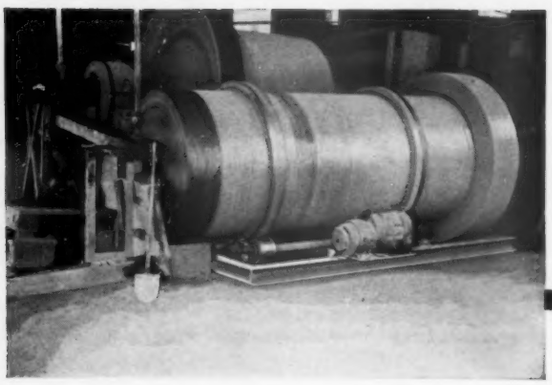
Conical Ball Mill



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A CLASSIFIER that rolls the sands free of slimes. The strongest and most efficient of all mechanical classifiers.

A MILL used the world over because it costs less to run and keeps running. Ask any operator who has run all types. Write for full information—Bulletin 41—*today!*

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Many Large and Small Operators Using

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Like all revolutionary kinds of equipment it had the usual battle with tradition, but as one operator after another discovered its tremendous advantages in speed and economy its use spread like wildfire.

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You'll never know what you are losing until you try TIMKEN Bits. The sooner you adopt them the less you will lose. Write for name of nearest distributor.

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Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
ROCK BITS

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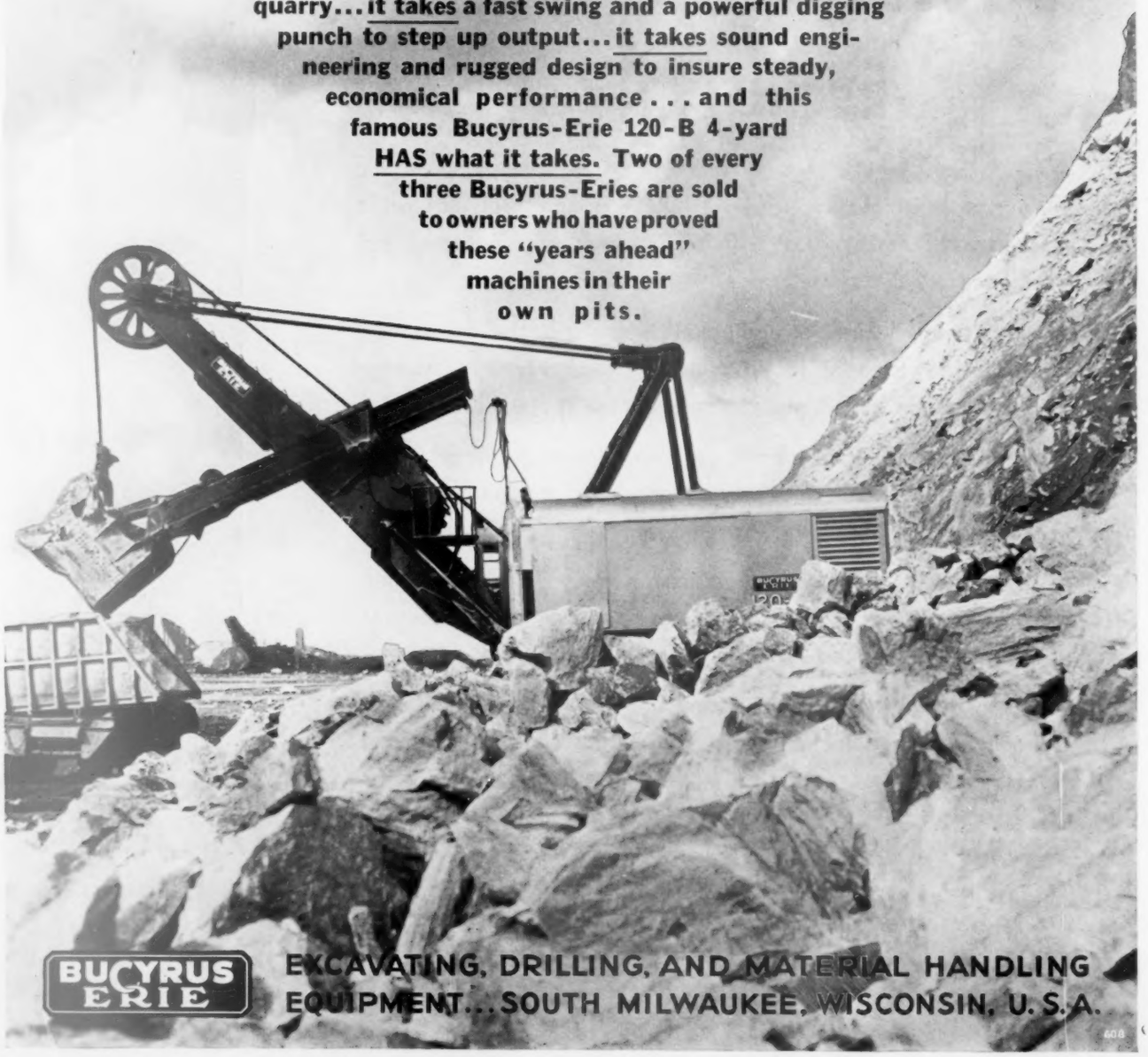
In tough digging » »

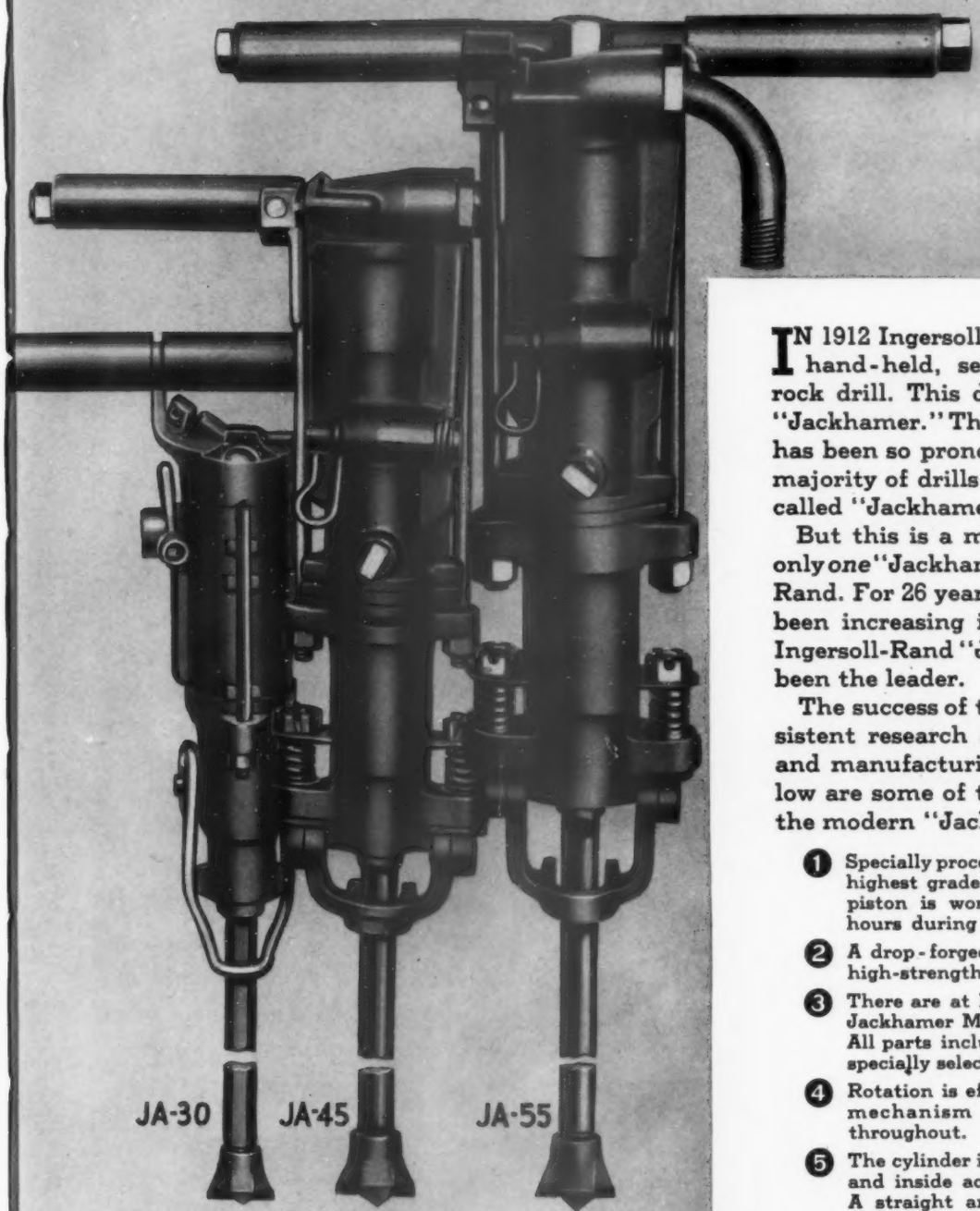
It takes a time-tested, job proven shovel to stand up to the pounding punishment of heavy digging in mine or quarry... it takes a fast swing and a powerful digging punch to step up output... it takes sound engineering and rugged design to insure steady, economical performance . . . and this famous Bucyrus-Erie 120-B 4-yard HAS what it takes. Two of every three Bucyrus-Eries are sold to owners who have proved these "years ahead" machines in their own pits.



BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN, U. S. A.

If it's a "JACKHAMER" IT'S AN INGERSOLL-RAND



IN 1912 Ingersoll-Rand introduced the first hand-held, self-rotating, hammer-type rock drill. This drill was trademarked as a "Jackhamer." The popularity of this machine has been so pronounced that even today the majority of drills of this type are commonly called "Jackhamers."

But this is a misconception. There is still only *one* "Jackhamer" and that's an Ingersoll-Rand. For 26 years this style of rock drill has been increasing in popularity. And it's the Ingersoll-Rand "Jackhamer" that has always been the leader.

The success of this drill is the result of consistent research and refinements in design and manufacturing methods. Tabulated below are some of the outstanding features of the modern "Jackhamer."

1. Specially processed forged pistons made from the highest grade of "shock resistant" steel. Each piston is worked on approximately fifty-five hours during the process of its manufacture.
2. A drop-forged fronthead held in place by two high-strength alloy steel through-bolts.
3. There are at least nine forgings on a standard Jackhamer Model.
   All parts including the forgings are made from specially selected materials.
4. Rotation is effected by a rifle bar and ratchet mechanism with ample bearing surfaces throughout.
5. The cylinder is also a drop forging with the ends and inside accurately ground after hardening. A straight and uniform bore assures correct alignment of working parts.
6. The "large area" valve provides for quick piston acceleration, and is largely responsible for the fast drilling speed and low air consumption.
7. Continuous flow lubrication is supplied to all working parts from the extra large oil chamber in the cylinder front washer or backhead according to the model.

SOLVE YOUR DRILLING PROBLEMS WITH IR JACKBITS

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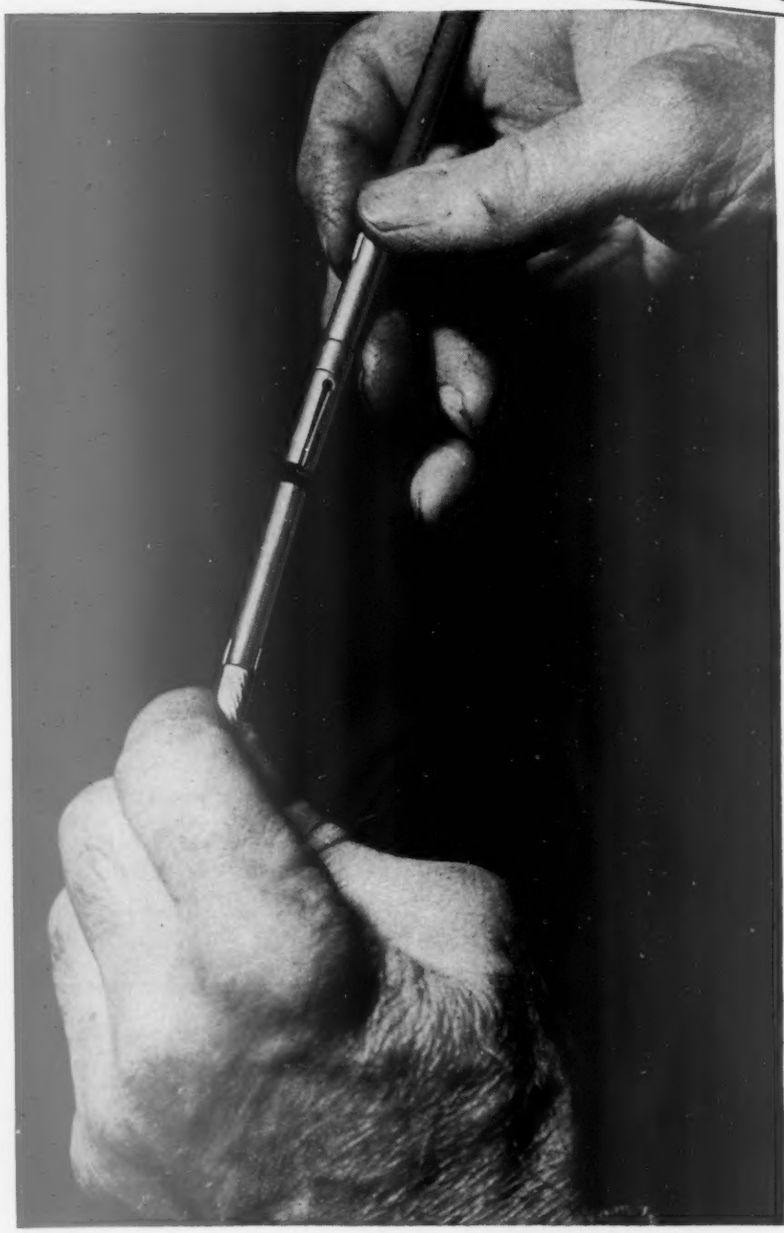
An Insensitive Load until you apply the Cap



EASY as using a key . . . for a detonating cap is required to unlock the mighty force of Cordeau-Bickford Detonating Fuse. It is insensitive to ordinary shocks, fire or friction. Its use eliminates the need for caps in the separate charges and reduces the time of loading holes and connecting up preparatory to making the shot.

Though very insensitive, Cordeau explodes with great violence. Extending from top to bottom of each hole, it is in contact with every cartridge, and detonates the charge *throughout its entire length.* The result is greater effectiveness, with consequent savings in material removal costs and better opportunities for profit.

CB73

THE ENSIGN-BICKFORD COMPANY • SIMSBURY, CONN.

CORDEAU·BICKFORD *Detonating Fuse*

Consolidated Sand & Gravel, Sioux Falls, S. Dak., load 50 tons of rock per hour with this ¾-yd. Lorain-40 shovel.

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Lundquist-Underwood Co., Utica, Mich., use a ¾-yd. Lorain-40 dragline in their gravel pit.

SMALL *but* MIGHTY

THE Lorain line of ⅜ to ¾-yd. shovels and cranes is made to order for those gravel pit and quarry jobs that demand the services of small capacity machines with power and strength out of proportion to their size.

Every unit in the line is built to those same proven principles of Center Drive design which have figured so prominently in the success of their big brothers (the Lorain "77" and "87") in this industry. And in addition, they feature the patented sloping machinery frame—the single greatest factor in giving the maximum stability and capacity per pound of weight of machine.

Through the use of interchangeable boom equipment, any of these units can be adapted to a variety of jobs, such as stripping, loading, or material rehandling. If you're looking for a small size shovel, clamshell, or dragline with a big capacity for hard work, write today for catalogs describing the ⅜ to ¾-yd. Lorains.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

THEW CENTER DRIVE
REG. U.S. PAT. OFF.

LORAINS

⅜ to ¾-YD.

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Offer a Valuable
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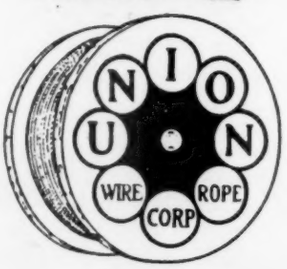

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The "ULTIMATE LOW COST WIRE ROPE"

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AUG 11 1938

PIT AND QUARRY

Vol. 30 June, 1938 No. 12

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Flow sheet showing Raymond Separator serving two 7'x28' tube mills. Legend: E, elevator; F, feeder; H, hopper; S, separator; T, tube mills.

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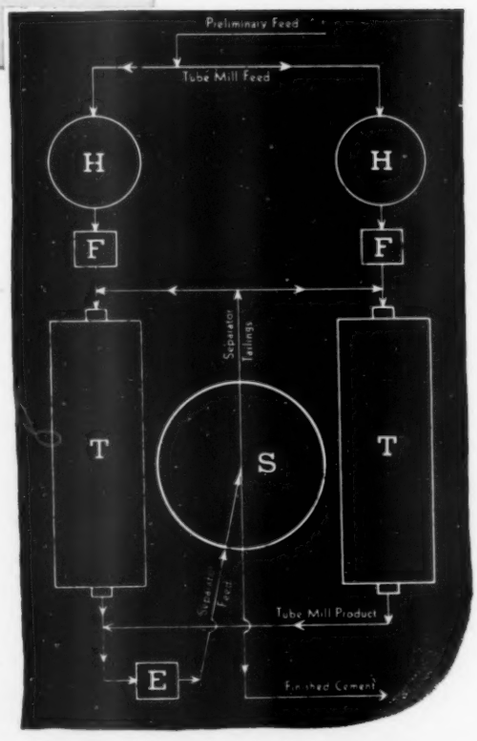
STANDARD CEMENT: With the Raymond Separator in closed circuit with two tube mills, an output of 190 to 210 bbl. per hour is produced at 1800 surface area. This is better fineness and greater capacity than obtained in open circuit grinding, which averaged only about 1530 surface area at 180 bbl. per hour.

HIGH EARLY STRENGTH CEMENT: In changing to this grade, the operator simply adjusts the exterior control slides on the Separator and uses a finer preliminary feed. The Raymond Separator produces 84 bbl. per hour of finished material, testing 2860 surface area, and showing a tensile strength of 342 for 1-day, 432 for 3-day and 517 for 7-day cement. Previously, this plant was unable to produce the high early cement without the Raymond Separator.

You will find it easy to meet today's rigid cement specifications with the Raymond **double whizzer** Separator. Write for details.



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PIT AND QUARRY

CHICAGO JUNE, 1938

Treasury Dept. Opens New Bids for Cement

PREVIOUS ORDER IS MODIFIED

Pursuant to invitations issued April 29 by the Procurement Division of the Treasury Department, bids were opened in Washington on May 12 covering 250,000 bbl. of cement "for use of the executive departments of the Federal government in California." Shipments are proposed to begin about June 15 and are to be spread over a six-month period at the rate of approximately 40,000 bbl. per month. Briefly, the California order was confined as above stated to executive departments of the Federal government and the cement was not to be made available to contractors on projects wholly or partially financed from Federal funds, and an effort was made to overcome other objections raised against the April 15 order by undertaking more specifically to give an estimate of the requirements of the Federal government.

Stanton Walker, director of engineering, National Ready Mixed Concrete Assn., in a letter to members, points out that, "notwithstanding this retreat from the advanced policy announced earlier, the Federal government, as to its California cement requirements, stipulated that 'no bids will be considered unless based on a price delivered f.o.b. cars at the bidder's mill or mills.' Thus the attack on the basing point system used by the cement industry and other industries continued, and a situation was created which prejudiced every industry which by tradition has sold on a delivered price basis."

Seven companies submitted bids. The invitation stipulated paper sacks. The low bidder was the Monolith Portland Cement Co. of Los Angeles, at a price of $1.63 per bbl. and a discount of 10 c. for payment within 30 days. Other bidders, in the order of quoted price, were the California Portland Cement Co., the Riverside Cement Co., the Calaveras Cement Co., the Pacific Portland Cement Co., the Santa Cruz Portland Cement Co., and the Oregon Portland Cement Co.

California companies submitting bids on April 15 and failing to do so on May 12 were the following: Henry Cowell Lime & Cement Co., Blue Diamond Corp., Ltd., of Los Angeles, and Southwestern Portland Cement Co.

"Some confusion seems to exist as to just what the Procurement Division will now do after the California bids have been received," Mr. Walker explains. "It is believed that while the low bid has been 'accepted,' the purchase of cement by the Federal government will be on the basis of the lowest delivered cost. In other words, the low mill price will be only presumptive evidence of a favorable position by the manufacturer and the Federal government, in issuing a purchase order for cement, will be guided by a review of all costs and will issue orders to such manufacturer as may, at a given consumption point, have the lowest delivered cost. If this understanding is correct, the Federal government itself seems to be justifying the traditional method of cement distribution, which, it is pertinent to add, has protected the ready-mixed-concrete manufacturer and has enabled our industry to constantly increase its market and its influence in the construction world."

Bids were also taken during May on small quantities of cement for delivery in Oregon, Utah, Colorado, Texas, Ohio, West Virginia and New Jersey. The policy of the government in the requirements of the bidders in each instance was along the lines of the California invitation.

Lime-Putty Plant to Be Built at Indianapolis

The State Sand & Gravel Co., Indianapolis, Ind., which recently took over the Allied Ready Mixed Concrete Co. at the Indiana capital, is shortly to add lime putty and the delivery of ready-mixed brick mortar to its line of products. The lime putty is to be prepared and marketed under Brooks-Taylor patents. W. L. Heston is general manager.

Indiana Occupational-Disease Act Ruling

COURT CLARIFIES LIABILITIES

Indiana's state occupational diseases act was clarified on several points by the state appellate court on May 13 in a ruling given to the state industrial board in the case of Arnold Jeffries, who was discharged because of silicosis by Dalton Foundries, Warsaw, Ind., on July 23, 1937.

The court ruled that an employee was not eligible for compensation if he was not employed for 60 days after June 7, 1937, the date the act went into effect, or if he was not employed for a 60-day continuous period. The court also held that the last employer is liable for payment of compensation, regardless of when the disease was contracted.

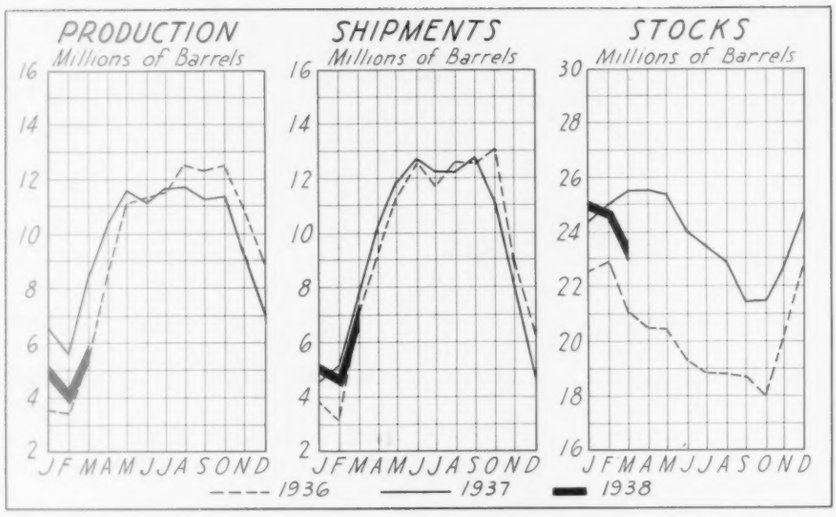
The court's opinion read, in part:

"Undoubtedly the legislature did not intend by passage of this act . . . that it should be retroactive. . . . To receive compensation the employee must have been in the employment of the company not less than 60 days after the effective date of this act. No employer would be liable to pay compensation in any case of silicosis in which the disability occurred prior to the effective date of the act."

Under the ruling, Jeffries was denied compensation. However, he is still entitled to file a damage suit against his former employer.

Dewey Improves Plant; Operations Are Resumed

Operations at the Dewey (Okla.) Portland Cement Co. plant were resumed April 11 after a two-month shutdown, during which extensive improvements were made. Kilns in the clinker burning department have been equipped with an improved type of magnesite lining, and a new stone-drying department was installed. New grinding equipment and a dust-collecting system will be put in operation in the near future.



The Portland cement industry in March, 1938, produced 5,879,000 bbl., shipped 7,259,000 bbl. from the mills, and had in stock at the end of the month 22,981,000 bbl., according to the Bureau of Mines, decreases of 30.4 and 7.9 per cent., respectively, as compared with March, 1937. Portland cement stocks at mills were 10.3 per cent. lower than a year ago.

British Columbia Lime Firm Must Raise Wages

In the first arbitration award under British Columbia's new industrial dispute conciliation and arbitration act, the Pacific Lime Co. was ordered to increase wages of certain of its 100 employees at Blubber Bay, B. C., re-employ any men on the payrolls at the beginning of the dispute, and improve working conditions.

Under the terms of the act, both employers and employees have 14 days in which to accept or reject the award. Employees will conduct a secret ballot under government supervision on the settlement. If either side rejects it, notice may be given and the right to strike or force a lockout may be retained.

Concrete-Pile Concern Sues Under Patman Act

The Helms Concrete Piling Co. of Alexandria, Va., has brought suit against several pipe manufacturers in the Federal courts of Virginia for triple damages alleged to have been caused by the manufacturer selling at a lower price in the territory of the Helms company than elsewhere. It was alleged that this was done for the sole purpose of injuring Helms' business.

Damages of $75,000 are claimed, and triple that amount plus attorney's fees is demanded.

Celotex Buys Pottsco Aggregates Plants

The Celotex Corp. has announced the acquisition of full rights to manufacture, distribute and sell Pottsco lightweight concrete aggregate from the Pottsco Corp., Chicago. The product is made by treating molten slag, with a controlled volume of water at a controlled temperature, creating a vitreous clinker of porous cellular structure. This is reduced by crushing and screening to desired size.

Harry H. Potts, originator of the product and president of the Pottsco Corp., is serving as manager of the Pottsco department of the Celotex Corp. Plants for producing this material are being operated at Chicago, Ill.; Youngstown, Ohio; Pittsburgh, Penn.; Buffalo, N. Y.; Birdboro, Penn.; and Troy, N. Y.

Lone Star Will Spend $2,075,000 on Mills

An expenditure of $2,075,000 for plant additions and improvements has been authorized for this year by the Lone Star Cement Corp., according to the concern's annual report. Specific 1938 improvements will include the erection of a new steam power plant in Brazil at a cost of more than a half-million dollars and modernization of the Spocari, Ala., mill.

The concern's new Parana, Argentina plant was completed late last winter and went into production early this spring.

Mineral-Wool Operation Being Built in Kansas

The P. J. Sonner Burner Co. of Winfield, Kan., is reported to be erecting a mineral-wool plant at Winfield. Associated in the operation of the new venture will be Victor and O. W. Mottweiler, pioneers in rock-wool production at Alexandria, Ind.

A.S.T.M. to Convene June 27 to July 1

GATHERING AT ATLANTIC CITY

During the week of June 27 to July 1, inclusive, the forty-first annual meeting of the American Society for Testing Materials will be held at Chalfonte-Haddon Hall, Atlantic City, N. J. To provide sufficient time for the presentation and discussion of the some 100 technical papers and reports on the program, some 18 formal sessions are being scheduled. These sessions are developed so that the papers and reports covering specific materials fields and topics will be grouped.

In addition to a large number of committee reports, there will be numerous papers covering non-metallic materials, including contributions on the freezing-and-thawing test for building brick, and effect of shape of specimens on the apparent compressive strength of brick masonry. The effect of using a blend of Portland and natural cement on the physical properties of mortar and concrete will be covered and drying shrinkage of concrete as affected by many factors will be described; also short-time creep tests of concrete in compression and hard strength between concrete and reinforcing steel. The grading-density relations of granular materials, and a study of the Wagner turbidimeter will be presented.

Other subjects to be covered in various sessions will include the effect of sulphur on the properties of asphalts.

New River Gravel Co. Formed in Arkansas

A $15,000 sand-and-gravel plant is being constructed five miles north of Harrisburg, Ark., by the Jeffery-Keys Sand & Gravel Co., Batesville, Ark. The company, recently organized, also operates several boats and barges on the White River between Batesville and Oil Trough, removing sand and gravel from the river. Co-owners of the firm are Roy Jeffery and Carl Keys.

New Texas Wool Plant to Operate Shortly

A new mineral-wool plant, operated by the Edwards Insulation Co., is reported to be about to start operating at Temple, Tex. The plant is said to have a capacity of about 20 tons daily.

The Le Grand Limestone Co. has taken over the assets of the Marshalltown Sand & Material Co., in Marshalltown, Ia.

Construction Awards Still at High Level

NEW PROJECTS SWELL TOTAL

Building and engineering contracts awarded in the 37 states east of the Rocky Mountains during the month of April amounted to $222,016,000, according to F. W. Dodge Corp. While this total figure was 18 per cent. below the one for April, 1937 (last year's peak month), it was only 2 per cent. under the total for March, 1938. Six out of fifteen districts included in this eastern territory showed increased total contracts over April of last year.

While the number of small-house units increased 5 per cent. over March, apartment contracts were somewhat smaller, and the April dollar total for all residential building, $74,577,000, dropped 6 per cent. from the preceding month and fell 31 per cent. below the peak figure of April, 1937. Non-residential contracts in April amounted to $80,435,000, compared with $96,326,000 in April, 1937, and $87,823,000 in March, 1938; commercial and industrial building continued on moderate levels and public building projects have been somewhat on the increase. Public-works contracts, amounting to $57,631,000 last month, increased 27 per cent. over the corresponding month of last year and 18 per cent. over March of this year.

Public-utilities construction, amounting to $9,373,000 in April, fell somewhat behind both April, 1937, and March, 1938. Publicly-financed projects of all kinds ran 34 per cent. ahead of April, 1937, and privately-financed projects ran 37 per cent. behind last April.

Commenting on the April construction record, Thomas S. Holden, vice-president of the Dodge organization, states: "The April construction record, a little disappointing to hopes of speedy revival, seems to indicate more than anything else a lag in the return of business confidence. New plans for construction projects continued to accumulate last month. During the past 16 months, Dodge has reported $2,077,000,000 in contemplated residential building, during which time, $1,135,000,000 worth of residential contracts were let. This 83 per cent. excess of contemplated new work over contracts is a quite reliable indicator of accumulated demand, since the usual excess is only 50 per cent. Confirmation of these figures is seen in the records of mortgages selected for appraisal by the F. H. A., which began to rise considerably in March, and mortgages accepted for insurance (a later stage of F. H. A. procedure), which in April increased 26 per cent. in total over April of last year. Significant of a better prospect for future months is the fact that no large-scale housing projects, either private or public, of the many that have been planned, have yet appeared in the contract record. Also indicated for later months are increased public-building and engineering projects under the proposed new Federal public-works program. Deferred industrial plant and public utility projects also await the starting spark of revived business confidence."

Cebu Portland Cement to Erect Pier at Naga

The Cebu Portland Cement Co., in the Philippine Islands, plans to build a pier at Naga to facilitate shipment of cement from the plant. Construction is expected to start shortly.

At present the company ships its cement by railroad from Naga, where the factory is located, to Cebu, the nearest port, for shipment to other points in the archipelago.

Production is being stepped up to supply the government with cement it will need in its huge four-year public works program. The capacity of the mill at Naga is being increased and more laborers are being employed, it is reported.

Indexes of Employment Drop; Payrolls Lower

The index of employment in the cement and stone-products industries declined from 70.3 in March, 1937 to 55.4 in March of this year, according to the U. S. Department of Labor. Payrolls likewise declined, the March, 1938 index being 48.0 while a year ago it stood at 66.1.

Employment in March gained 8.5 per cent. over February in the cement industry but only 2.7 per cent. in quarrying and nonmetallic mining, according to Isador Lubin, Commissioner of Labor Statistics.

Alabama Lime Producer Adds Two More Kilns

Two new vertical kilns 56 ft. high were recently placed in service at the Landmark, Ala., plant of the Cheney Lime & Cement Co. of Birmingham. The company also operates two other plants at Graystone, Ala.

The American Sand & Gravel Co., Hattiesburg, Miss., has purchased the assets of the Myles Sand & Gravel Co., Utica, Miss.

Mississippi Mineral Resources Surveyed

W.P.A. ALLOCATED $117,000

Supported by a $117,000 allocation by the WPA, the Mississippi Planning Commission and the State Geological Survey have jointly undertaken a survey of Mississippi's mineral resources.

The project is under the supervision of Dr. W. C. Morse, state geologist, who will use the laboratories at the University of Mississippi in testing minerals taken from the co-operating counties. The survey has been started in Winston and Lauderdale counties.

Among the non-metallic minerals believed to exist in commercial quantities are bauxite, pottery clay, bick clay, China clay, and building stone. Traces of paint pigments and ochres and silicious filtering earth have been located.

Oregon Firm Accused of Evading Gravel Royalty

The Oregon state land board has filed a suit in the circuit court at Salem, Ore., against the Newberg Sand & Gravel Co., charging that the company has refused to pay $12,000 in gravel royalties to the state irreducible school fund. The board also asks for an accounting from the firm for gravel removed from the Willamette River bed and applies for an iniunction against further operations.

The company is accused of having taken 120,000 cu. yd. of gravel from the river without paying the 10 c. per cu.yd. royalty fixed by the land board and to have denied the state's domain over the material.

Johns-Manville to Go Ahead with New Plant

The Johns-Manville Corp. recently announced that it would proceed with plans for the construction of a new $1,000,000 insulating-board plant at Jarratt, Va. Initial operation of the plant is planned for early in 1939. Lewis H. Brown, president, said that between 300 and 400 men would be required for full operation.

To Grind Feldspar at New Carolina Plant

Plans for the erection of a feldspar finishing plant at Thermal City, near Rutherfordton, N. C., are being made by Realty, Inc., Hendersonville, N. C., which recently purchased 190 acres of land which have extensive feldspar deposits.

Road Surveys Under Way in 45 States

POINT WAY FOR CONSTRUCTION

Highway-planning surveys, now being made by 45 states in coöperation with the U. S. Bureau of Public Roads, will provide factual data for sound policies to be followed in long-term programs of road construction.

These surveys, which are being limited to fact-finding investigations, embrace studies involving road inventories, traffic movements, and financing methods. Under the head of road inventories the physical data of a state's road system are being tabulated and studied. During the past 20 years extensive permanent improvements have been made in most of the states in grading, eliminating bad curves, and widening roads. Such costs are generally non-recurrent, and for that reason these improvements should tend to bring about a reduction of future highway costs. A number of states are employing the stage construction method in building bituminous roads. This sets up a stable foundation suitable for carrying heavy traffic, and tends to reduce road improvement expenses.

In some states, clearing, grading, and similar work other than surfacing have constituted a major part of road construction costs. The expense of such work should diminish in the future. Unit costs for maintenance and reconstruction also should decline, for highway engineering has made great strides and better roads are being built today than ever before.

Although the studies of traffic movement have been completed in only a few states, sufficient data have been obtained to indicate that most motor vehicle traffic is of limited movement. Only a small part extends beyond a radius of 150 miles of its starting point. This is true even in the congested area about New York City. Less than 5 per cent. of the 82,000 vehicles which cross the Hudson River daily go beyond Pennsylvania, studies have shown.

The traffic surveys further indicate that grandiose plans for a national system of "super-highways" are more or less absurd, and that only comparatively short stretches of road in a few sections have sufficient traffic to justify the enormous expenditures necessary to build super-highways.

On many roads leading out of large cities, the problem of peak traffic loads is being studied. The leisure time of most families is concentrated in the week-ends, resulting in a sharp increase in short-distance traffic at that time. Since highways which are crowded on Sundays carry only light traffic on week days, it is believed unwise that road facilities be developed at tremendous cost to cut down the traffic congestion caused by Sunday drivers. Alternate low-cost routes, possible in most cases, are seen as solutions of the week-end peak-load problem.

There are many factors to be taken into consideration in highway planning in any state. These surveys will provide for the first time complete factual data on the various factors to be considered in making road improvements, and they should lead the way to sound policies for long-term programs of highway improvement.

Colonial Leases Yard Site Along East River

The Colonial Sand & Stone Co., New York, N. Y., has leased for a long term the vacant East River frontage between 53rd and 54th Sts., formerly occupied by the Materials Delivery Corp. Deep-water dock facilities are included. The company plans to use the site as another distributing yard, receiving sand and gravel by barge from Long Island.

Resumes Operations at Plant as Strike Ends

The Martin's Creek, Pa., plant of the Alpha Portland Cement Co. has resumed operating after being closed since last October when a strike was called.

About 300 men are being employed following the agreement to end the strike.

Builds Concrete Pipe Plant at New Orleans

A concrete-pipe plant is under construction on the Industrial Canal at New Orleans, La., by the Louisiana Materials Co., Inc. W. L. Stevens is president. The plant, of steel construction, will cost about $30,000.

Marquette Now Making Patented Mortar Cement

Masonry cement manufactured by the Blank process is now being produced by the Marquette Cement Mfg. Co., Chicago, Ill. Patents on the process are held by the Cement Process Corp., New York, N. Y.

Oregon Silica Company Acquired by Bristol

The Silica Products Co., of Rogue River, Ore., has been succeeded by the Bristol Silica Co. Fayette I. Bristol is general manager.

More Rigid Silicosis Compensation Sought

N. Y. LEGISLATURE GETS BILL

Upon recommendation of Industrial Commissioner Elmer F. Andrews, the New York Legislature is considering a bill to put compensation for total disability or death due to silicosis or other dust diseases on the same basis as that for accidental injuries and death.

The amendment provides for stepping up the compensation gradually over a period of 5 years. This recommendation is based upon experience under the present act which indicates that compensation for silicosis is materially less costly than was predicted by the opponents of the act. During the first 18 months of operation under the silicosis amendment there was a total of 18 awards with an approximate cost of $12,000. The pending amendment carries a further recommendation of the commissioner liberalizing the period of time allowed for medical treatment. Here again experience has shown that the limitation of medical treatment of 3 months in the present statute lost sight of the cases that were complicated by tuberculosis.

Recent Equipment Installations ★ ★ ★

Two batching plants, one a Heltzel and the other a Butler, were recently installed by Criss & Shaver, ready-mixed-concrete producers at Charleston, W. Va. . . . *The Vincennes Gravel Co., Vincennes, Ind., has placed a Miles concrete-block machine and a Blystone mixer in service at its concrete-products plant.* . . . Blaw-Knox batching equipment has just been installed by the Arundel-Brooks Concrete Corp., Baltimore, Md.

A Traylor jaw crusher, mounted on a flat-car, has gone into service for crushing large bowlders in various parts of the Roscoe quarry of Consolidated Rock Products Co., Los Angeles, Cal. . . . *A Multiplex concrete-block machine and two Caterpillar Diesel engines are recent additions at the Brewer & Brewer Sons plant at Chillicothe, O.* . . . A Telsmith-equipped sand-and-gravel plant owned by George N. Schwartz has gone into operation on Belair Road, Baltimore, Md.

Snow equipment, including a new air-tamping concrete pipe machine, has been installed this spring by the Peerless Concrete Pipe Corp., Orange, Cal. . . . *A Hummer vibrating screen and a new dredge ladder are recent equipment additions at the May Bros. operations near Fairmont, W. Va.*

A new Sturtevant air separator has been installed in the raw mill at the Riverside Cement Co., Riverside, Cal. . . . *A 75-ft. Jeffrey bucket elevator has been installed at the plant of the Ross Concrete & Mortar Co., Huntington, W. Va.* The Sgoda Corp. has installed a Rotostoker at its Granitesville, N. C., plant where it fires a Ruggles-Coles dryer.

National Crushed Stone Assn.
National Lime Assn.
National Slag Assn.
Portland Cement Assn.

WITH THE TRADE ASSOCIATIONS

National Sand & Gravel Assn.
National Industrial Sand Assn.
National Ready Mixed Concrete Assn.

JUNE, 1938

Stepanian Heads Ohio Ready-Mix Association

Stephen Stepanian, Arrow Sand & Gravel Co., Columbus, O., was named president of the newly-organized Ohio Ready-Mixed Concrete Assn. at its first annual meeting at the Dashler-Wallick Hotel in Columbus on April 22.

Claude L. Clark, executive secretary of the Ohio Sand & Gravel Assn. was named secretary. Other officers include: Henry Beckley, Springfield, vice-president, and C. E. Ehle, Cleveland, treasurer.

Directors are C. E. Kuhlman, Toledo; M. J. Byrnes, St. Bernard; William Goldie, Cleveland; R. O. Davies, Mansfield; P. Milliron, East Liverpool; A. A. Hilkert, Akron, Stepanian and Clark.

The association adopted a constitution and by-laws, headquarters of which will be at 403 Majestic Bldg., Columbus.

June Safety Drive on Among Cement Plants

Safety is always the watchword in the Portland-cement industry but it will have special significance during the month of June. For the twelfth successive year, the Portland Cement Assn. is staging its June No-Accident Campaign. Special campaign groups have been organized in each plant; plant inspections and safety appraisal of physical properties were undertaken during May in preparation for the drive.

Plant safety mass meetings were held May 31, and ceremonies attendant to the raising of the new P. C. A. safety flag took place at each plant at sunrise, June 1. Andy Seezit, the sharp-eyed cartoon character who made his appearance in connection with the June Campaign in 1937, has put in an appearance at the mills and his entire attention will be centered during the month on the winning of the famous June Campaign which has now become an annual classic among the mills.

New plans for improving plant safety committee meetings and introducing educational features are the principal subjects of discussion at a series of conferences of cement plant superintendents held in centers convenient to the various groups by the Portland Cement Assn.

The trend of the ideas being developed is along lines of concentrating and shortening routine features of plant safety meetings in order to provide time for a planned schedule of safety educational features. The improvement of plant safety meetings is a subject that has been engaging attention of the Accident Prevention Bureau of the Association for some time.

Another subject that is receiving much consideration at these conferences presents a method of analysis of plant safety work in order to determine its efficiency and discover the weak points.

Coming Events

June 3, 1938, Pittsburgh, Pa. — Semi-annual meeting of board of directors, National Ready Mixed Concrete Assn., William Penn Hotel.

June 16, 1938, French Lick, Ind.—Mid-year meeting, board of directors, National Crushed Stone Assn., French Lick Springs Hotel.

June 21-23, 1938, Dallas, Tex. —Summer meeting, board of directors, National Sand & Gravel Assn., Adolphus Hotel.

June 27-July 1, 1938, Atlantic City, N. J.—Annual meeting, American Society for Testing Materials, The Chalfonte-Haddon Hall.

August 29-September 3, 1938, Grand Rapids, Mich. — Power Show and Mechanical Exposition, National Association of Power Engineers, Civic Auditorium.

September 30-October 1, 1938, Urbana, Ill.—Sixth Annual Illinois Minerals Conference, University of Illinois.

October 10-14, 1938, Chicago, Ill. — National Safety Congress and Exposition, Stevens Hotel.

World Silicosis Parley Planned for September

Plans are being concluded by the International Labor Office at Geneva, Switzerland, for a world conference on silicosis early in September. Expected to attend are industrial medical experts from the United States, Great Britain, South Africa, Japan, France, Denmark, Canada, Belgium and Australia.

The conference will study and exchange information on such questions as dust sampling, intensity of exposure to dust, the pathology of silicosis, industries involving risks of the disease, methods of prevention, and the determination of the worker's disability and degree of disability.

The idea of the conference originated from a resolution sponsored by John G. Winant and Miss Frieda Miller, U. S. delegates to the International Labor Conference in 1936.

Seriousness of the disease is revealed by statistics of the U. S. Department of Labor, which estimates that 1,000,000 American employees in industry are exposed to its dangers.

Gypsum Output Drops in First Quarter

The decline in production and sales of gypsum and gypsum products that began in the July-September quarter of 1937 persisted through the January-March, 1938, period. Reports to the Bureau of Mines for the first quarter of the current year show decreases compared with the corresponding January-March period of 1937 in all of the classifications except wallboard.

The decline of 28 per cent. from the corresponding 1937 quarter in the apparent crude supply resulted from a 25 per cent. decrease in domestic production and a 77 per cent. decline in crude gypsum imported.

Calcined gypsum produced declined approximately one-fifth from the January-March period of 1937. Total sales of uncalcined gypsum, which are composed chiefly of sales for Portland-cement retarder, declined more than one-fourth from the corresponding 1937 period. All calcined gypsum sold for manufacturing uses in the current quarter declined one-third from the first quarter of 1937.

EDITORIAL

Fear and Its Effects on Business

MANY of the large number of speakers and writers who have attempted to explain some of the phenomena of mass inaction so evident in these days have emphasized the element of fear in present-day behavior as an important factor in accounting for the apparent unwillingness of large groups of people to take economic action in directions to which they have become accustomed. The business man, they say, hesitates to engage in new undertakings, to expand his existing enterprises, or even to carry them on along lines known to be practical, all because of his fear of what may happen. The consumer is unwilling to buy beyond his day-to-day or hour-to-hour needs, even in the absence of the restrictive pressure of inadequate purchasing power, because he does not know when his income may cease or be sharply curtailed. The investor of small means sews his money in his mattress or hoards it in a safety-deposit box, because he is mistrustful of the ability or integrity of those to whom in a less fearful mood he would have entrusted the management or use of his savings. These fears range all the way from the mere sense reflex of primitive organisms to the rationalization of the highest stages of mental development.

Fear, the psychologists tell us, is one of the primary emotions. In the field of lower or organic emotion it is the feeling that arises in a situation that demands the making of a practical adjustment; in the field of higher or intellectual emotion it arises from the expectation of something disagreeable. It may have more than one source. The strangeness or suddenness of an event may so disconcert one that a fear of almost paralyzing intensity may seize him, or the idea or object presented may awaken memories of previous painful experiences associated with it or something similar to it. Fear is a negative reaction toward occurrences; it retards, it holds back, it discourages, it cautions, it dissuades, it nullifies the effects of normal action stimuli, it destroys activity. It is dignified in the mind of the rational man by such complimentary terms as "prudence," "good judgment," "conservatism," "careful consideration," "thorough investigation." It furnishes all the arguments for doing nothing, for leaving things as they are, for expecting the worst to befall from any contemplated change. Fear touches the very heart of the instinct of self-preservation.

Fear of this kind is a normal emotion common to all forms of organic life, and it is found on all levels of intellectual development. In its normal forms it has been largely responsible for the preservation of many forms of life which, without it, would have perished in the competitive struggle. In its normal expression in human affairs it has contributed greatly toward the development of some degree of stability, while at the same time it has undoubtedly often blocked the path of progress. We may accept as true Burke's statement that "early and provident fear is the mother of safety," and yet feel, as Shakespeare did, that "Of all the wonders that I yet have heard, it seems to me most strange that men should fear."

THERE is nothing peculiar about these times that should make men unduly apprehensive. We live in the midst of plenty, in an environment that is ready to provide satisfaction to the utmost of our wants. We have developed a technology that can give us many good things at little cost, and in the future lies the promise of still greater comforts and achievements. Yet, despite the fact that there is no economic justification for misgiving, as many economists have demonstrated, thousands of men hesitate to act, believe that it is useless to plan ahead, mistrust the soundness of even their own judgments. Business men who are accustomed to taking risks, whose business by its very nature requires the taking of risks, are reluctant to commit themselves to even ordinary expenditures needed to preserve the efficiency of their plants or to maintain their positions in their markets. Those who work for wages, those whose desires are never satisfied and are, for that reason, the greatest stimulus to business enterprise, hesitate to buy anything outside the necessities of daily existence. Men with surplus funds content themselves with the small interest returns of savings banks and government bonds, rather than court the risks of investment in industrial production.

Fear may be becoming a habit, a state of mind. Surely we have no lack of "viewers with alarm" and "prophets of calamity" to imbue us with apprehensions and dire forebodings. They have made of us a people with "more pangs and fears than wars or women have." They have so disturbed our sense of confidence that it is often difficult to win conviction even with irrefutable factual evidence. What should be a healthy open-mindedness has been converted into a cynical unwillingness to believe anything, however good the proof.

All these varieties of fear current in America to-day are injuring business, which needs badly the patronage of those who can still afford to buy more than

their fears allow them to buy, and the funds of those who should invest in plants and equipment for greater industrial production but are held back by what one commentator has rather mildly described as an "excess of caution." Yet it may be asked whether certain kinds of businesses are not largely responsible for the creation and the continuance of this fear complex that keeps so many people inactive. It may reasonably be wondered whether the widespread use of the appeal to fear in an effort to sell goods has not contributed to that state of uncertainty, that reluctance to act, which is affecting business so unfavorably. One may question, too, whether this state of mind does not also make business men unduly apprehensive of political trends as well as of economic conditions which they seem to think themselves powerless to change.

A CASUAL examination of any of the popular magazines gives a fair indication of the extent to which one of the primary emotions has been exploited to push the sales of certain types of commodities. Men, women and children, business men, professional men, workers—no one who reads is likely to escape the repetitive and diverse appeals that are made to his fears. Long before the normal fears of the average person had been exhausted by advertising writers new ones had been invented, and almost every one of these has been given some new and more horrible aspect in the race for sales supremacy. There is scarcely an activity in human life that has not been surrounded by imaginary terrors and deliberately-contrived horrors as means to stimulate the public's will-to-spend. Even where this will-to-spend can be exercised because of an ability-to-spend there is developed a nervous tension, an emotional instability, that may become pathological. And where inadequacy of income makes the gratification of the will-to-spend impossible the sense of frustration, the discouragement, the feeling of futility, must seriously affect one's ability to take a sane view of social, political and economic events and problems. As if modern life were not sufficiently complex and sufficiently taxing of our powers of adaptability and adjustment, new fears, unjustifiable fears, must be added to the normal difficulties of trying to achieve a healthy and happy existence. Various types of neurosis are on the increase in this country, and the growing tendency to rely on the fear appeal in modern merchandising may offer part of the explanation. Eminent neurologists have said that 95 out of 100 cases of painful experiences in connection with certain normal human functions "are caused by fear and expectation of pain." Some manufacturers in recent years have profited greatly by exaggerating and exploiting this fear.

In a recent address Wallace B. Donham, dean of the Graduate School of Business Administration of Harvard University, made some pertinent remarks on this use of the emotional appeal.

"I am going to point out just one area in which the advertising profession to-day is a great offender in its use of emotional appeals," he told his audience. "Given widespread loneliness and fear, many men are susceptible to appeals based on fear. Many are turned into neurotics filled with personal fears by the advertising of the current day by its emphasis on fear as an appeal. Advertising needs to clean house of fear advertising. It isn't true, and every advertiser knows it isn't true, that women have to depend for their success in matrimony on designated cosmetics and they should not be threatened into the use of cosmetics. Countless generations of men have got along with acid stomachs, if, indeed, any of us have acid stomachs. We don't need to be threatened and turned into hypochondriacs by the use of threats and fears. Corporations and advertising men who use such methods are playing with fire.

"I have picked out for criticism one aspect of advertising but the one that is, I think, to intelligent observers of the situation, perhaps the most disturbing aspect of advertising. It is emphasizing fears at a time when there is a real question whether the present business recession will turn into a serious collapse or only a brief dip. Widespread fear is a danger to all business. The immediate future depends, in my judgment, on the courage of America more than it does on any economic forces at work. If advertisers continue to create multitudes of neurotics and hypochondriacs in the effort to sell immediate goods, they are complicating America and jeopardizing their own future. You are all members of a group which is filled with fear because of political changes but many of you are creating just as dangerous fears. It is no answer, even in the short view, that such methods do in fact sell goods."

PRODUCERS of minerals and manufacturers of machinery have not been guilty of playing with human emotions in this way, but they have carried part of the burden which widespread fear imposes on business in general. Thousands of manufacturers who, but for their fear of the future, would probably enlarge their factories; hundreds of thousands of workers who, but for their fear of losing their jobs, might build small houses; many more thousands of investors who, but for their fear of loss, would contribute toward the building of new commercial, institutional and residential structures—these are the points where irrational fear checks the advance of our own industries. Business men who are affected by these emotional drags on their businesses may not have the power of censorship over fear-arousing advertising, but they could advise and warn against the use of methods that disturb the poise and power of making independent judgments on the part of the public at large.

R. R. DUMP CARS CONVERTED TO TRAILERS

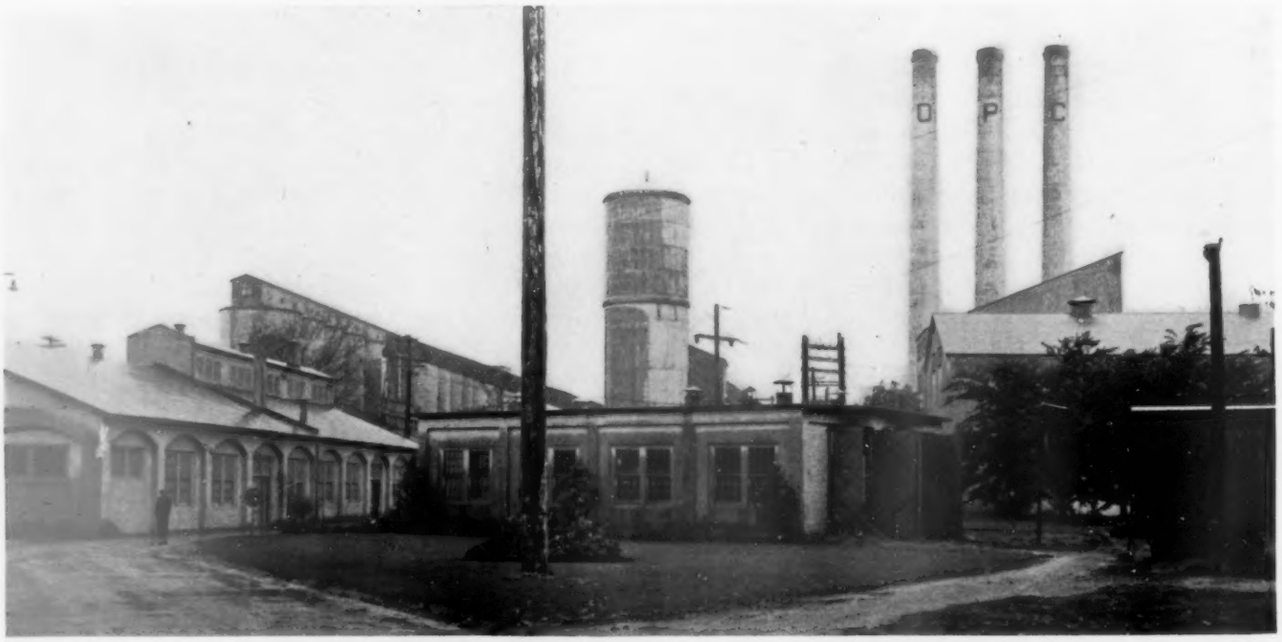
The 3-cu.yd. electric shovel loading two of the 8-cu.yd. quarry cars which have been converted into trailers.

The Diesel tractor hauling two of the steel side-dump trailers to the crusher while the other two were being loaded.

ONE of the northernmost cement plants in the United States is that of the Olympic Portland Cement Co. at Bellingham, Wash., built in 1913. This plant is about 20 mi. south of the Canadian line and is supplied with stone from a quarry which is even nearer the border. A further distinction is the fact that this is the pioneer wet-process plant in the West.

The original crushing plant was located near Limestone, Wash., about 30 mi. east of Bellingham on the then C. M. & St. P. Rwy., but in 1929 a new quarry was opened on the side of a near mountain and a new crushing plant was built there. A balanced-type tramway was installed to carry the stone down the mountainside to a transfer station, and a second tramway terminates at a new loading bin at the foot of the mountain. Each section has two 40-cu. ft. buckets which balance each other. This entire installation was designed by F. L. Smidth & Co. Leschen cables and buckets were used. A description of this plant was published in the March 12, 1930 issue of PIT AND QUARRY, and the old quarry and plant were described in the Sept. 29, 1926 issue.

No changes have since been made in the crushing plant proper, but in 1936 the original system of railway haulage in the quarry was abandoned. A single



A partial view of the plant of the Olympic Portland Cement Co. at Bellingham, Wash. In the left background are the cement storage silos.

Stone being dumped from one of the trailers into the primary crusher.

Caterpillar RD7 Diesel tractor replaced the two 8-ton gasoline locomotives. Four of the 8-cu. yd. side-dump steel quarry cars were converted into trailers by equipping them with flat steel wheels, and they are now hauled a distance of several hundred feet to the crusher by the tractor. Two trailers are loaded while the others are in transit. A Caterpillar 60 gasoline tractor equipped with a bulldozer is used to keep the quarry floor clean. The drilling and blasting methods used follow usual practice. Stone is loaded by a No. 100-B Bucyrus electric crawler shovel with a 3-cu. yd. dipper.

The stone is dumped into the Allis-Chalmers 42-in. gyratory primary crusher, which discharges it into a surge bin. A pan feeder supplies the 7-ft. Symons cone secondary crusher. A belt-conveyor carries the minus ⅝-in. product of this crusher to the 500-ton bin, from which the tramway is loaded at a point about 125 ft. below the quarry floor level. The crushing plant has a capacity of 250 tons per hr. Both the crushers in this plant have operated since their installation in 1929 with no repairs or replacements of any kind. In that period they have crushed about 2,500,000 tons of rock.

The first section of the Leschen aërial tramway is 790 ft. long with a vertical drop of 380 ft. The stone is discharged into a 50-ton bin at the transfer house, where the second section of the tramway is loaded. This section is 1,330 ft. long with a vertical drop of 700 ft. It discharges the stone into a 1,000-ton concrete silo from which the cars are loaded for the cement plant.

The cement plant was built in 1913 and was designed by F. L. Smidth & Co., who supplied much of the important equipment. As this plant was completely described in the two issues of PIT AND QUARRY already mentioned, this article will be devoted mainly to the improvements made since that time.

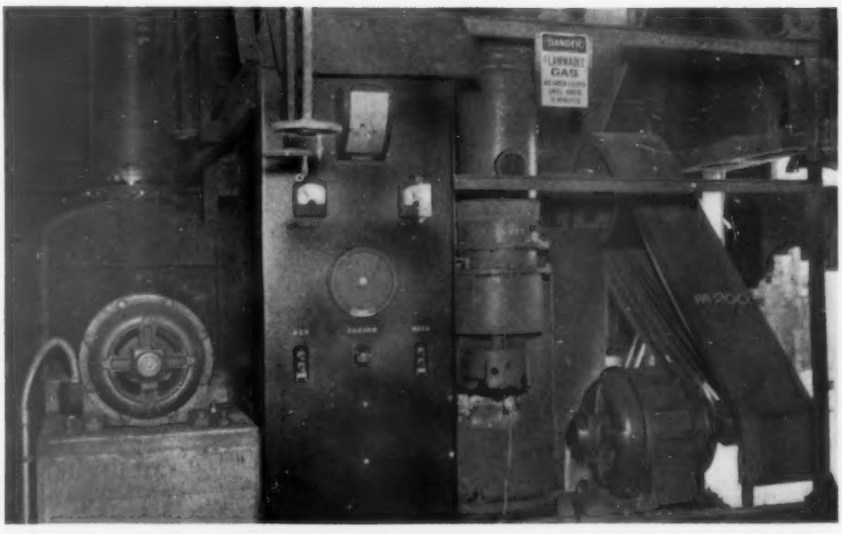
Important improvements made prior to the publication of the last article included the installation in 1925 of a third 9-ft. and 10-ft. by 170-ft. Vulcan rotary kiln, a third 40-ft. F. L. Smidth rotary cooler, another kiln stack, and accessory equipment. In 1928 eight new concrete storage silos were built, increasing the cement storage capacity to 150,000 bbl. F. L. Smidth Fluxo pumps were installed on the side of these silos to feed the cement to the new packing building. These silos are now used for the storage of Coulee Dam and high-early-strength cements and the ten older silos are used for standard Portland cement. A Unidan mill was also added in the finish-grinding department.

Since that article was published operations have been further improved. In 1935 four new concrete slurry-blending basins were built. Each of these is 36 ft. in diameter and 30 ft. high and is equipped with an F. L. Smidth combination mechanical and air agitator. Two Wilfley pumps, one 4-in. and one 6-in., were installed for circulating and pumping out the slurry from these tanks.

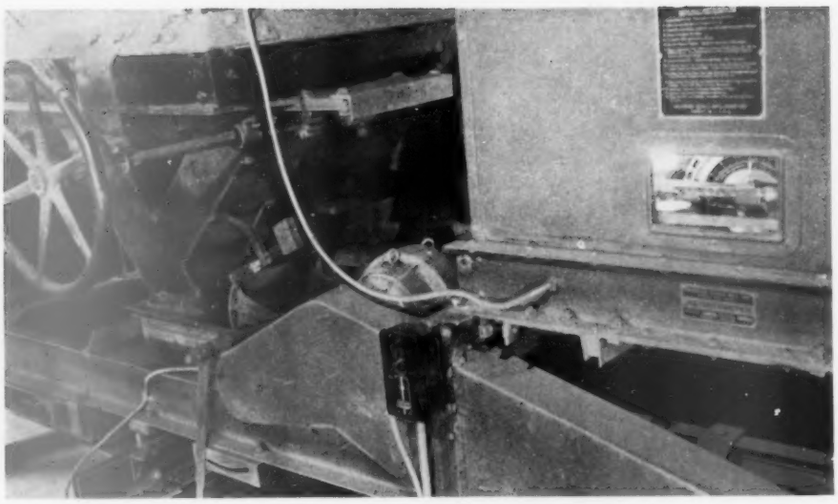
In 1935 it became necessary to provide additional silica for the manufacture of low-heat cement for Coulee Dam. A quartz quarry 3 mi. from the limestone quarry was opened. The same tractor and bulldozer are used to scrape the quarried quartz into a hopper, from which trucks haul it to the railroad for shipment to the cement plant. At the cement plant a Traylor 14-in. by 24-in. jaw crusher was installed and this discharges the crushed quartz into a section of the stone storage.

In 1937 a General Electric Selsyn system was installed to synchronize the slurry feed with the kiln speed. An automatic Merrick Weightometer scale was installed in April of this year to insure accurate control of the amount of clinker ground. There being no belt conveyor available for the usual type of installation, an ingenious combination was installed, consisting of a Weightometer complete with a short pivoted conveyor, using a 24-in. wide flat belt about 12 ft. between centers, and with a

The storage silos and packhouse with the older silos at the left.



One of the direct-firing coal mills with fan at left and control board in center.



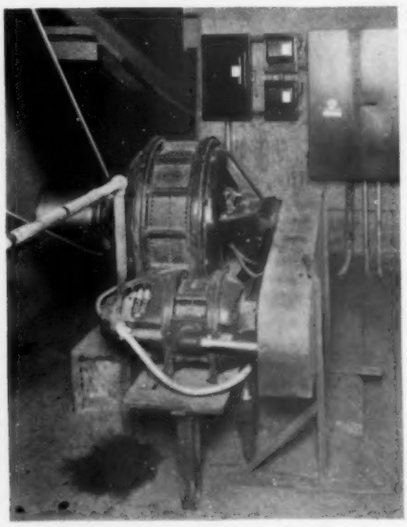
The automatic weighing device which records the amount of clinker ground.

capacity of about 70 tons per hr. The weighing belt is installed below a clinker supply bin and discharges on a Link-Belt drag-chain conveyor. Gypsum rock can also be handled over this same equipment.

The most important recent improvement was the installation early in 1937 of three Babcock & Wilcox direct-firing coal mills for the three kilns. These mills replaced a bin system of pulverized-coal firing which had been in use since 1918, when firing with fuel oil was discontinued. The Kominuter and tube-mill from the coal department were transferred to the finish-grinding department to increase its capacity. Fuel-oil firing can be resorted to in an emergency, but at present price levels it would be uneconomical for steady operation.

According to A. F. Krabbe, superintendent, these B & W coal mills have reduced the coal consumption about 6 per cent. and have eliminated the labor of 4 men. Much of the fuel saving he attributes to the elimination of the drying and handling losses inherent in the old system. The use of the direct-firing system has also resulted in a much cleaner plant, which is important because it is near a residential section of the city. These are said to have been the first direct-firing mills installed on a kiln floor. The coal used comes from washers 2 mi. away and is hauled to the plant by the company's locomotive and cars. Its B.t.u. value varies from 10,000 to 10,400.

The pneumatic conveying systems which feed cement from the silos for shipment.



The kiln motor with transmitter unit of synchronized slurry feed system in foreground.

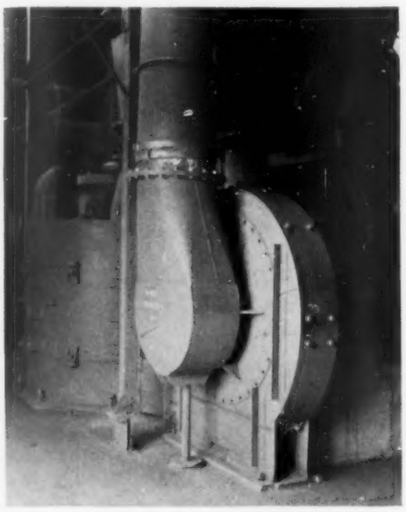
The old coal Kominuter is served from one of the original bins in the finish-grinding department. It discharges to an elevator feeding one of the tube-mill bins. The old coal tube-mill is fed by a screw from this bin.

Limestone is dumped from cars into the 9,000-ton storage building from which it is withdrawn by a belt-conveyor. A pan-conveyor distributes it into bins feeding the three No. 85 Kominuters in the raw-grinding department.

Clay from a pit 5 mi. from the plant is unloaded into an 8,000-ton clay storage or into the wash-mill hoppers. The resulting clay slip is stored in an agitating basin from which it is pumped to feeders above the Kominuters.

Each Kominuter is operated in closed-circuit with a Type 400 Hum-mer screen, which returns the oversize material and feeds the undersize to a 7-ft. by 22-ft. tube-mill. The third stage of raw grinding is performed by two 6½-ft. by 10-ft. Cylpeb mills. The slurry goes into any of four 2,800-bbl. correcting basins. The mixing is accomplished in one of the four basins from which the slurry is pumped into three 2,000-bbl. storage tanks under the kilns.

Pumps supply the ferris-wheel feeders for each of the three 9-ft. and 10-ft.



Another view of one of the direct-firing coal mills and fan.

by 170-ft. Vulcan rotary kilns equipped with the F. L. S. chain system. Three 40-ft. Smidth double-shell pressure rotary coolers discharge the clinker on a belt-conveyor running to the 170,000-bbl. clinker-storage. Clinker is fed by a belt-conveyor from storage into the finish-mill feed bins.

At the time the plant was last described the finish-grinding equipment consisted of two No. 85 Kominuters, two No. 18 Smidth tube-mills and a 3-compartment Unidan mill. These have been supplemented by the Kominuter and the tube-mill already mentioned. A series of screw- and belt-conveyors carry the finished cement into the 10 old cement-storage silos, which have a capacity of 10,000 bbl. each. Smidth Exbiners feed a screw-conveyor system which serves two 4-tube baggers in the packhouse.

Production, Research and Utilization of Lime Chief Topics of Discussion as N. L. A. Convenes at Cincinnati

DRAWING producers from 17 states and Canada and one from Australia, the twentieth annual convention of the National Lime Association was held in Cincinnati May 9 to 11. Following a meeting of the board of directors in the forenoon, the association's president, S. Walter Stauffer, delivered the opening address on the *Responsibility of the Individual in Association Activities.* In speaking of some of the changes that have occurred in the political psychology of the country since its foundation he said:

"If you will read the constitution, you must be impressed with the fact that the primary consideration of that document was not the creation of an all-dominant government. It was the protection of the rights and liberties of the individual and freedom for the individual to exercise those rights. Food, clothing, shelter, security were recognized as the problem of the individual and not of government. Freedom of worship, freedom of speech, freedom to work and prosper or loaf and starve, freedom to save and provide comforts for old age or to spend and end your days in poverty and misery, these were the rights of every individual, and government was not to infringe upon these rights and liberties. Under this government we progressed. Men grew strong and erect and in this atmosphere of freedom, they built their homes and reared their families in self-respect.

"It was not long, however, before paternalism entered into our government. This was first evidenced by the creation of unnecessary jobs for relatives and friends of those in office and for political workers. This, of course, tended to create inefficiency, but that is the price we pay in this country for self-government and, as long as it is not overdone, we can afford it.

"Then minority groups sought special privileges and received them by a pledge of allegiance to the party in power, but at the expense of individual freedom. Later, in order to protect men from the consequences of their own acts, corporate bodies were created by law and we turned further away from individual freedom and responsibility. Instead of enacting laws for the greater protection of the individual, we enacted laws for the benefit of these special groups, often at their request. Please do not misunderstand me, I am not condemning group action, corporate or otherwise, but am attempting to point out the trend in this country from individualism towards collectivism. But if we are to have dominant groups, they must assume individual responsibilities and must be guided by the same codes of morals and ethics as individuals. We, as a group, can not ask special consideration from government for ourselves and expect individuals not to do likewise. We can not condemn paternalism towards others, if we seek it for our group.

"We — and when I say we, I, of course, go beyond this group assembled here—we, ourselves, are partly responsible for the present government excesses. We have sought special favors, we have winked at special favors, until it has become the common belief that government exists solely for the purpose of supporting the people. During the past few years minority groups have sought and received ever greater benefits from government, both federal and state, always at the expense of individual freedom. Under N.R.A., in return for stability of prices and profits, industry accepted government control of wages and hours and in many cases control of production. Under A.A.A., in return for bonuses and cash payments, the farmer agreed not to raise hogs, permitted the slaughter of his cattle, limited the cultivation of his own acres, which was his God-given right. Under W.P.A. and P.W.A. individuals and whole communities have been bribed with government funds. Under the National Labor Relations Act, in return for the promise of ever-higher wages and shorter hours, labor has given up its constitutional right to work, except by mandate of its self-appointed leaders, the same leaders who prescribe rules that prevent the development and progress of the individual, yet who prate about the constitution, which guarantees those inalienable rights to the individual. Some emergency measures may have been necessary at a time of serious depression, but, as subsequent events have proved, power once delegated is not easily retrieved and, as history proves, liberties once bartered away can only be repurchased at terrific cost."

This led him to a discussion of individual responsibilities, in the course of which he emphasized the importance of lime as a material in the national economy.

"I want to talk with you for a few minutes about the last of these attributes, individual responsibility. We are a part of a great industry. We take from mother earth one of the crudest of raw materials and transform it into a useful article in commerce. Thousands of men are gainfully employed in our manufacturing plants, and three or four times their number are dependent upon us for their living. The fertility of our soil, the permanence of our buildings, the production of many of the necessities of life depend on our products.

"Our industry, therefore, has a great responsibility to provide this essential material. In order to provide it we must first have capital. It is not enough that nature has provided unlimited quantities of our raw materials and apparently inexhaustible supplies of fuel. These must be mined and quarried. They must be assembled at one location, and buildings and equipment must be made available for their conversion. We must have management to direct and coördinate the necessary activities. Not only must capital be provided, but production must be efficiently directed, markets must be cultivated and expanded, research must be conducted in order to improve our products or to develop new ones, pay-rolls must be met,

and bills must be paid. It is no easy job that management has and this is best indicated, I think, by the fact that over 90 per cent. of all business ventures are failures.

"But above everything else, we must have men. Even management is nothing more or less than men. To-day we hear a great deal about capital and labor. Capital is spoken of as though it were a living thing, with a conscience or mostly without one, with a will, and as having the ability to choose between the right and wrong. Labor is referred to *en masse* and not as an individual. It is supposed to include, as a group, all those who work in mines, quarries, factories, and on construction. But capital does not have life. It may be money, it may be land, it may be a building. It can not conceive good, neither can it do evil. It is subject to the will and conscience of men. Neither is labor a commodity and, like commodities, subject to purchase in a competitive market. Labor is men, the same kind of men that are responsible for management, the same kind of men that you and I are. Labor is a human being with a heart, with a soul and with a brain, with ideals and with aspirations, with perfections and with faults. . . .

"What is our individual responsibility? To you men who work in quarry or plant, I would like to suggest that your first responsibility is to do your job the very best that it can be done. Careless selection of stone, improper firing of a kiln, negligent care of machinery, indifferent loading of a car, any of these things may cause the loss of a valued customer and both your company and you suffer thereby. Second, you have a responsibility towards your fellow workman. You should be interested in his safety and not jeopardize it by failure on your part to work safely. You should be interested in helping him to do a thorough job, for failure on his part might mean loss of work for you. You should not deny him the right to work by interference in any way, for make no mistake, your liberty and right to work depends on his. . . .

"You men engaged in selling also have a great responsibility. The men in quarry and plant depend on you to provide work for them to do at a livable wage. Management depends on you not only to bring in orders, but to create good will, to furnish reliable competitive information, to determine market trends. Capital depends on you for a fair return. When you fail, all suffer.

"On you also is placed the responsibility of observing fair trade practices. This responsibility must not be minimized. Many of our recent laws have resulted from a growing public rebellion against certain business practices. Whole industries are feeling the effects of the wrongful acts of a few of their members. When you disparage another's product to-day, you create suspicion of all industry products to-morrow. Secret rebates and price discriminations may bring temporary gain to-day, but can only result in losses to-morrow.

"The greatest responsibility, however, rests with you men in management. Upon your social consciousness depends the welfare of your employees; upon your business judgment depends the success or failure of your company; upon your vision depends the present and future of our industry. To-day, as never before, the lime industry and all industry is undergoing rapid changes. Government regulations more and more restrict our course of action, old manufacturing methods are no longer efficient, new products confront us at every turn. The supremacy of a product is never secure in a given market. . . ."

He dwelt upon the necessity for the industry's remaining alert to the threat of competitive materials, saying in part, "Is it not clear that we in the lime industry must be ever alert to protect our markets? Building codes, city and state, must be followed, government and other specifications must be watched, architects and builders must be informed. In the chemical industries processes must be studied, technical information must be developed and be made available to consumers and potential consumers of our products. The public must be told about lime. Due to your vision, you men in management have recognized these responsibilities. For the purpose of discharging them, some years ago you organized the National Lime Assn. and delegated to it certain of them. We in the association recognize that it is our job to do many of the things mentioned above. We also recognize that it is our duty to serve each member, each group, impartially, with fairness to all, favoritism to none."

The *Mutual Responsibilities and Interests of the Lime and Fertilizer Industries* were discussed at some length by Myron S. Hazen, manager of the Service Division of the American Agricultural Chemical Co., New York. He traced the changes in the technique of soil testing when he said, "First, and probably most important, both from the standpoint of your industry and our own, is the development, standardization and general acceptance of the so-called pH scale. Twenty-five years ago we started to make our first crude soil tests . . . going into the field with strips of litmus paper, carefully selecting a moist handful of soil, fracturing it in the center and then pressing the litmus paper between the two portions. If the paper turned red we told the farmer to use lime and plenty of it. If by some strange chance it showed blue we told him with equal definiteness that he did not need any lime. While it was customary to take a number of samples from different portions of the field, relatively few workers ever prepared a composite sample and these crude tests, instead of representing the field as a whole, usually represented a few isolated spots where the samples were secured. With the coming of the pH test and its improvement, both through the electrolytic and colorimetric methods, we are now in position to tell the farmer not only whether his soil is sour or sweet, but to give him specific information with respect to the amount of neutralizing material which he requires for any given crop. . . .

"By the method of trial and error a lot of hard work and a great deal of constructive thinking there have gradually been developed a series of so-called rapid soil tests, the basis of which is an attempt to duplicate in the laboratory the absorptive capacity of the average growing crop and to determine, not with chemical accuracy but in general terms, the plant-food levels of a given soil. Even the most enthusiastic supporter of the rapid soil tests would not be prepared to consider them as more than indicative. They do, however, place in the hands of a well-trained agronomist who is familiar with the soil and crop conditions of a given area an additional tool to help him recommend a soil fertility program which is adapted to the particular field under discussion.

"From the standpoint of better farming the third development, which is perhaps more significant and of greater fundamental value to the farmer, is the gradual accumulation of a fund of knowledge with respect to the effect which changes in the pH scale have on the whole crop-producing power of the soil. In the old days when we found a soil that was sour we confidently recommended lime in some form. It did not make any particular difference then whether we were dealing with a light sandy soil or a heavy clay loam. Now we realize that the application of lime not only corrects the acidity, but creates an entirely new set of soil conditions which must be understood and taken into consideration in a soil management or soil fertility program. I would summarize these advances from the standpoint of the farmer and from the standpoint of the ability of our respective industries to serve the farmer better, briefly as follows:

"First, the ability to determine accurately the kind and amount of lime required; second, the ability to determine the plant-food levels of the major mineral elements, notably phosphoric acid and potash; and, third, a better under-

standing of the changes which occur in the soil when a change is made in its pH value. . . ."

On the subject of coöperation between the lime and fertilizer industries Mr. Hazen asked, "Why should lime interests encourage the use of fertilizer? Every man here has heard the old Scottish adage 'Lime and lime without manure makes both farm and farmer poor.' While there is the ever-present competition for the farmer's dollar, I think that it is worthwhile for us all to remember that the problem of plant feeding is primarily a problem of balance. In our own organization we frankly tell farmers in many instances that it is a waste of time for them to purchase commercial fertilizer until they have corrected the pH value of their soil to a point where the crops which they wish to grow will thrive. . . .

"It is far saner from the standpoint of building a sound agricultural program to encourage a farmer to divide his available funds in a rational manner than for either the fertilizer manufacturer or the lime manufacturer to attempt to 'grab more than his legitimate share.'" The work of the National Joint Committee on Fertilizer Application has developed a great fund of very valuable knowledge with regard to the proper placement of fertilizers with respect to the seed or seed piece. With the exception of grain crops, which are fairly resistant to fertilizer injury and can, therefore, be planted in the combination grain and fertilizer drills, the experiments in general show that the best results are obtained where the fertilizer is applied in two bands, 1 to 3 in. distant from the seed or seed piece and slightly below the level of the seed piece. This method of fertilizer placement makes it practical to go ahead and apply the lime broadcast and work it into the soil, and then immediately plant without waiting for the lime reaction to be completed.

"Under the old broadcast method it was the ever-present danger of reverting the phosphoric acid of the fertilizer to insoluble form, when the lime and fertilizer were applied at the same time. The question which the average farmer asks most often is 'What kind of lime should I use?' Taking the country as an average, the answer would be 'any kind.' Those of us who have had an opportunity to study the results obtained from various types of lime and who recognize the chemical variations are more selective in our advice.

"In our own work we prefer to use dolomitic hydrate in all areas where the magnesium deficiency is known to be important. In those areas where the native supply of magnesium is adequate a high-calcium lime is equally satisfactory. The hydrate has a distinct advantage over the ground limestone because it is usually more active and it is, therefore, possible to foretell within reasonable limits the changes in the pH of the soil which a given application of lime will produce.

"On a general farm, where neither tobacco nor potatoes are grown in the rotation and where the pH values do not have to be as accurately controlled, finely-ground limestone of either the dolomitic or calcium-carbonate type will give excellent results. In many sections these are the only forms that can be obtained locally.

"The question which is important from the standpoint of the lime salesman and the fertilizer salesman is the amount of lime which should be applied at any one time. In our earlier experience it was customary for us all to recommend a quantity of lime sufficient to bring the pH value of the soil up to a neutral point or nearly so. While such a recommendation is necessary and probably justified, when crops like alfalfa, sweet clover or certain of the other legumes are to be planted, it should be accompanied by specific instructions to be sure that half of the lime is applied before plowing and the remainder certainly in the form of a hydrate applied on the rough furrow and thoroughly harrowed into the soil in order to insure prompt neutralization. As a general proposition our experience shows that the best results are obtained where small applications of lime are made regularly in the rotation, rather than to apply a large amount of lime at any one time. Particularly in the case of a top-dressing operation on mixed hay, legumes or old pastures the application of hydrated lime should never exceed half a ton to the acre even if this is applied during the dormant period. Where the carbonate form is used a ton can safely be applied. In connection with this modest application it should be remembered that lime moves very slowly in the soil and that if excessive amounts are applied on the surface, the top inch or two may be raised to a point well above the neutral

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and may depress the growth of the grass and clover.

"Our federal government, through the operation of the Agricultural Adjustment Administration and the various soil-improvement and erosion-control programs, has done more to publicize the importance of lime in successful agriculture than the industry could possibly have accomplished in a generation. While their programs vary the fundamental practices applicable in every state include:

"1. The growing of clovers and alfalfa either alone or in mixtures on high land.

"2. The development of good sods on permanent pastures.

"3. The production of sweet clover, lespedeza or other cover crops to be plowed under in rotational land.

"Each of these three major practices requires for its successful accomplishment the use of ample quantities of lime and in most areas considerable amounts of commercial fertilizer. Because of the fact that phosphoric acid is the greatest single deficiency in most sections, only that material is included in the benefit payments, except in a relatively few of the older agricultural states where nitrogen and potash are also vitally essential to successful seeding."

P. H. Bates, chief of the Clays and Silica Products Division, National Bureau of Standards, Washington, discussed the case of research by quoting extensively from the paper on that subject presented by Prof. C. H. Scholer before the twenty-first annual convention of the National Sand & Gravel Association at Memphis in 1936, which was reported in the January, 1937, issue of Pit and Quarry. On the subject of *The Important Characteristics of Lime in Construction Industries,* Walter C. Voss, professor of building construction, Massachusetts Institute of Technology, gave some interesting results on four different characteristics of lime: (a) volumetric and weight data on hydrated and slaked lime and their effect on mortar proportions; (b) volume changes in mortars; (c) the effect of lime on concrete; and (d) workability and sand-carrying capacity of mortar matrices.

"In discussing the first, I call your attention to a partial tabulation of the data which our laboratory obtained on samples some of you sent to us and check tests which in some instances a plant laboratory made," he said. "The average weight of compacted dolomitic hydrate is about 47.3 lb. per cu. ft. for the limes tested; for the compacted high-calcium hydrates the weight is 42.5 lb. per cu. ft. These two averages are sufficiently close together for us to fix a weight for a cubic foot of lime solids. I should establish this as the average of the two, or 45 lb. per cu. ft.

"I would also call your attention to the yield of putties at the end of 20 hr. . . . The variation is great, from 0.97 cu. ft. of putty per cu. ft. of quicklime for the first dolomitic lime to 3.70 cu. ft. of putty for the waterproofed, high-calcium quicklime. When we compare the yield in lime solids per cubic foot of putty we find 63 lb. for the first and only 31.3 lb. for the waterproof lime. This is extremely significant. It proves to a large extent the contention, which I have made on several occasions, that all limes will not give the same weight of lime solids per cubic foot of putty. . . . The average apparent specific gravity of the lime solids is close to that of the relatively-pure hydroxides, namely 2.33 for the dolomite and 2.24 for the high-calcium. Many of us have had the idea that the weight of the lime solids in a cubic foot of putty would be approximately the same, if the putties had the same weight per cubic foot. This we have found to be true within very small limits of error. . . . To make it more convincing I have plotted a curve showing the weights of the various putties in pounds per cubic foot plotted as ordinates and the weights of the corresponding lime solids per cubic foot plotted as abscissae. . . . These two variables have approximately a straight-line relation, as they rationally should. The equation of this curve is:

$$y = 0.588x + 62.0 \quad \text{and,}$$
$$x = 1.7\ (Y - 62.0)$$

in which y equals the weight of a putty per cubic foot at any given time, .588 is the tangent of the angle of slope, x equals the weight of lime solids in a cubic foot of such putty, and 62 is the intersection of the curve on the y-axis expressed in pounds per cubic foot. This may appear complicated, but it merely means that:

"The weight of lime solids in a cubic foot of putty at any given time after slaking is equal to 1.7 times the difference between the weight of the putty at such time 62 lb. . . .

"When an architect writes a specification such as this: 'The mortar shall be mixed in the proportion of 1 volume of Portland cement, 1½ volumes of lime solids in the form of putty, and 6 volumes of sand', he wants to be sure he gets lime solids and not water.

"With such a simple method at our disposal all we need to do is to determine the weight of the putty at any given time—say in the morning—and determine the number of cubic feet of putty required at such time. When this amount is mixed with the bag of cement and 6 cu. ft. of sand we will obtain uniform results. . . . Suppose the weight of the putty on a certain morning was 80.9 lb. per cu. ft. The calculation suggested would give the weight of lime solids as: $1.7\ (80.3 - 62.0) = 31.1$ lb. The actual careful laboratory determination in this case gave a value 33.4 lb., which is reasonably close. If we now assume that 45 lb. equals 1 cu. ft. of lime solids, we find that at this time our mix would be: 1 cu. ft. of cement, 2.17 cu. ft. of lime putty, and 6 cu. ft. of sand. . . . If we accept 45 lb. as a good average value for 1 cu. ft. of lime solids then our revised statement becomes:

" 'The volume of putty to use at any given time equals 26.5 times the volume of lime solids specified, divided by the difference between the weight of the putty per cubic foot and 62 lb.' Expressed as an equation this would be:

$$V_p = \frac{26.5 \times L,}{W_p - 62} \text{ in which}$$

V_p = volume of putty required, L = volume of lime solids specified, and W_p = weight of putty per cubic foot. For the specification given above this would again give us:

1 cement, 2.17 lime putty, 6 sand.

On the subject of volume changes Prof. Voss stated, "The study of the effects of lime in concrete shows that the addition of lime to concrete is advantageous rather than detrimental, as many would have us believe. In this connection we have made tests for strength, volume change and permeability. . . . The use of lime as a replacement of up to 10 per cent. of the weight of the cement can not be considered as detrimental to the strength. In the leaner mix with a high-lime content the strengths are on a par with the plain concrete. Another fact, which as yet we can not explain, is the apparent retrogression of most of the test cylinders at the 6-months period. This is less marked with the higher lime contents. The concretes with the higher lime contents also reduce the permeability and the volume change is not adversely affected.

"In making the tests for permeability we used the variable-head permeameter and found the volume of water passing through a 2-in. slice of a 6-in. cylinder in cubic inches per minute by applying the laws of lamellar flow. The results show that for both mixes the straight-cement concrete is more permeable than any of the lime concretes and that the use of lime as suggested is conducive to a 50 per cent. reduction in flow."

The third point is the workability and sand carrying capacity of mortar matrices. Prof. Voss stated in this connection that "In measuring workability

we had the idea that it was related to the plasticity and viscosity of the cementitious matrix, to the type of sand and its amount, and to the work which must be done to deform it. With this in mind I have proposed the following definition of workability: 'Workability exists in a mix in which the viscosity of the matrix allows distortion without segregation.' To test this definition it was decided to develop an apparatus which would deform the mortar and to measure the work necessary to cause this deformation. Such a machine has been built. We are not sure that its details are correctly proportioned. With the machine as it now exists we have been able to develop some interesting curves on workability for eight mortar proportions.

"Nearly all the tests fall upon a straight line. The equation of this curve is:

$$x = 3.98y + 1.90,$$

where x = volume of sand, and y = volume of lime used. In each case the volume of cement is considered as unity. Let us illustrate a mix by assuming that we will use 0.50 cu. ft. of lime solids to 1.00 cu. ft. of cement. The sand which can be used with these matrix proportions is therefore:

$$x = 3.98 \times 0.50 + 1.90 = 3.89$$

and the mix would be 1 cement, 0.50 lime, 3.89 sand.

"Similarly, for 2 volumes of lime solids the mix would be 1 cement, 2 lime, 9.86 sand.

"If no lime were used, the mix would, of course, be 1 cement, 0 lime, 1.90 sand.

"If no cement is used, the mix would be 0 cement, 1 lime, 3.70 sand. This is extremely significant to me and shows quite definitely that a good lime will carry more sand and still give a workable mix than the cement can when used alone."

He summed up his findings in the following words:

"The data I have given you seem to justify the following contentions, at least until some one disproves them with equally convincing data:

"1. That 45 lb. is a rational average value for 1 cu. ft. of lime solids.

"2. That it is only necessary to find the weight per cubic foot of a putty to determine the weight of the lime solids per cubic foot of putty.

"3. That apparent yields of putties are misleading and tend toward oversanding.

"4. That waterproofed limes give a putty light in weight and therefore give a fictitious yield and a more porous structure.

"5. That cement mortars require long periods for stabilization and always have greater expansion at a slow rate than high-lime mortars.

"6. That mortars made with dolomitic hydrates tend to shrink more than high-calcium putties.

"7. That mortars made with high-calcium putties have the lowest expansion after many cycles.

"8. That it is perfectly safe to use lime in concrete to replace 10 lb. of the cement with 10 lb. of lime solids.

"9. That the permeability of concrete is reduced at least 50 per cent. by the replacement of 10 lb. of cement by 10 lb. of lime solids.

"10. That the replacement of cement by lime solids in the amount given decidedly increases the workability, and that replacements with dolomitic hydrate were somewhat more effective.

"11. That cement can carry only 2.00 parts of sand to produce a workable mortar, while lime will carry at least 3.50 parts of sand and produce workability."

A very valuable paper of interest to the quarriers of lime in the middle western section of the United States was that on *Primary and Secondary Blasting in Limestone,* by F. D. Bickel, technical representative of E. I. du Pont de Nemours & Co. He discussed the subject by reviewing the history of the development of explosives and described the various types that have been in use at various times. This led him to a discussion of drilling methods, in the course of which he described the best practices for different conditions. He pointed out the necessity of adopting a drilling and blasting technique especially suited to conditions found in individual quarries.

"There are really only two principal types of quarries to be considered. The first is the pit type, so called because it is excavated below the level of the surrounding ground surface. It is most prevalent in the middle west because of the general topography of the country. The limestone strata usually lie flat or nearly so, and the thickness of the formation varies from a few feet up to several hundred feet. The limestone is covered by varying depths of overburden up to 50 ft. in thickness, heavy shale often being encountered in the greater depths which also has to be blasted to allow removal. When the overburden is too heavy for economical quarry methods, the only alternative is an underground operation. In the pit type of quarry the height of face is usually low, ranging from 20 ft. up to 70 ft., and can generally be controlled to suit conditions at hand.

"The second or side-hill type is prevalent in hilly or mountainous country and is formed by advancing a vertical face into a hillside which rises above the surrounding ground level. In this type the height of face varies according to the topography, ranging from a few feet up to 250 ft. The strata are generally on a pitch, which may vary from a few degrees to 90 deg. with the horizontal, which introduces problems different from those encountered in the pit-type quarry. . . .

"There are really only two principal methods of drilling which can be considered suitable for conditions encountered in pit-type quarries. Well drilling, being more flexible, is applicable under all conditions regardless of the type of the material or the height of the face, with the wagon-drill receiving consideration for faces from 20 to 30 ft. in height, especially when the material is hard and massive and a high degree of fragmentation is desired. . . .

Analysis of Attendance at the Twentieth Annual Convention of the National Lime Assn. Cincinnati, May 9 to 11, 1938

Producing Companies' representatives	61
(Companies represented)	(34)
Association Employees	7
(Associations represented)	(3)
Equipment-Manufacturing Companies' representatives	15
(Companies represented)	(9)
Trade-Publications' representatives	2
(Trade publications represented)	(2)
Guests (including 12 ladies)	23

Large Groups in Attendance

Ohio Hydrate & Supply Co.	5
Warner Co.	5
Valve Bag Co.	5
Cummer Lumber Co.	4
Eagle Rock Lime Co.	4
National Mortar and Supply Co.	4

(Three companies had 3 each, 6 had 2 each, and 28 had 1 each.)

"Whatever method is used, uniformity of spacing is essential, depth should be controlled by a system of levels and the profile with markers properly placed for use of the drill crews, and the proper amount of subdrilling to provide satisfactory execution in the bottom should be determined. Before making a shot markers should be set on the top of the quarry or bench a known distance back of the drill holes so the desired burden can be obtained for the next drilling without measuring back from the face, which is usually somewhat indefinite due to back break and broken stone piled up in front. . . .

"The tendency is to increase the spacing to the limit in order to allow the use of as long an explosive column as possible, as well as to reduce drilling and explosive costs. Actual experience shows spacings as great as 20 ft. by 20 ft. are possible in laminated easy-shooting limestone with a slip parting at the quarry floor. Under such conditions it is usually necessary only to dislodge the material and throw it down, so the pile will not be too high for safe shovel operation. . . . There is little or no secondary shooting. . . .

"The spacings will generally range from 16 to 18 ft. and the sub-drilling from 3 to 4 ft. It has been found, also, especially in massive material, that a better spread of explosive strength is obtained by making the spacing between the holes greater than the burden or distance back of the face. This tends to avoid shearing between holes and pushing the material out in long ledges. . . .

"In most types of stone single-row shooting is most satisfactory from the standpoint of breakage and explosives consumption. It also produces less back break and better bottom execution than double-row. . . .

"With certain combinations of conditions the so-called 'single-hole' shooting has been developed and has definite advantages where suitable. It is feasible in medium-height faces, where the material is well stratified, requiring practically no secondary shooting and where nothing less than a 3-cu. yd. shovel is in use. . . ."

Mr. Bickel had something to say on the subject of drill spacing and the amount of spalls. He gave some interesting information regarding wagon drilling and the cost when he said, "Most quarry operations strive for the minimum amount of spalls and fines, and much can be done in this respect by drill spacing and selection of explosive. Generally speaking an increase in spacing in connection with the use of the slowest acting explosive that will still give reasonable fragmentation should reduce fines to the minimum. . . .

"In certain types of stone, where the operating faces range up to 40 ft., the wagon-drill has been steadily replacing the well-drill, particularly in the lower faces, due to an actual reduction in drilling cost per ton of stone and to improved fragmentation because of the better distribution of the explosive. The wagon-drill is particularly well suited to use in massive stone, where well-drill holes are necessarily located 10 to 12 ft. apart to give fragmentation. . . .

"It should also be borne in mind that the wagon-drill is not practical in certain types of open, seamy or shattered stone, where there is a tendency to considerable overbreak from shooting, and under such conditions the well-drill is the only logical choice. . . .

"Evidence indicates well-drill costs of 15 to 25 c. per ft. in the medium-soft limestones of the middle west with wagon-drill costs varying from 3c. per ft. for 1⅜-in. holes up to 8c. for 2½-in. holes, with somewhat higher costs for depths above 25 ft. The explosive costs, including secondary, apparently range from 2c. per ton for the finely-laminated material up to 6c. for the harder massive limestones."

The side-hill type of quarry requires special methods which are described partly as follows:

"Three methods of blasting are possible with the side-hill type of operation: well-drill, tunnel and snake-hole, with the former, of course, predominating. In this type of quarry there is necessarily a great variation in the height of the face, the pitch of the stone and the direction of the face in relation to the dip of the formation, all of which have an important bearing on the method selected.

"Well-drilling, of course, makes possible the best distribution of the explosive and, therefore, is generally the most economical method for limestone. The best arrangement is for the face to parallel the dip of the strata as the back break can be kept to the minimum and the bottom shoots most easily. . . .

"In this type of quarry drill-hole spacings vary from 12 ft. to 20 ft. and burdens from 20 ft. to 25 ft. for the best results. When heavier burdens are encountered, good fragmentation is difficult to obtain, especially in the more massive materials. Sub-drilling varies from 5 to 8 ft. under most conditions. . . .

"The tunnel method is used when well-drilling is difficult and where a fair degree of fragmentation is obtained in the fall of the material. . . .

"While snake-hole shooting is not as prevalent as the other types, it is still used for some low-face operations up to 50 ft. high, where the material pitches steeply and is of such a nature as to be expensive to well-drill. The tripod holes are drilled at the toe 8 to 10 ft. apart and 20 to 30 ft. deep. . . . This method of shooting is usually very efficient as far as explosive consumption is concerned, producing as much as 5 to 6 tons per lb. The load per hole runs from 150 to 300 lb. Snake holes are often used in conjunction with well-drill holes in the side-hill type of quarry in cases of heavy toe, where it is impossible to load sufficient energy in the bottom of the well-drill holes to obtain breakage."

As Mr. Bickel pointed out, there should be as little secondary blasting as possible. In describing this problem he said in part:

"For any given set of conditions the first operation in which to reduce secondary costs is, of course, the primary shooting. Generally speaking, lowest overall costs are effected by obtaining in the primary shot the best possible results in line with maximum plant output. Although fine fragmentation may reduce secondary costs and increase shovel production, these advantages may be far overbalanced by the waste of explosives and the loss of product and general efficiency from excessive fines. The best procedure is a well-balanced combination of drilling and explosive charges to obtain as uniform breakage as possible, so that the shovel output will be up to plant capacity without excessive wear and tear on the equipment, to avoid an excess of either fines or extremely-large blocks and to lay the material out so as to allow sufficient secondary shooting in advance to make uninterrupted shovel operation possible. . . .

"Generally a 1⅛-in. jackhammer hole is sufficient for satisfactory breakage instead of 1½-in. or 1¾-in. holes often found, resulting in savings of about 30 and 50 per cent. respectively in drilling time alone. . . . There is a general tendency on the part of blasters to overload on secondary work resulting in a loss from excessive fines as well as of explosives. . . .

"In some quarries there is a tendency to shoot chunks ahead of the shovel rather than to lay them around in the shovel pit to be block-holed later. Under such conditions the chunks are usually mud-capped to avoid shovel delay, requiring from ten to twelve times as much of a more expensive explosive to do the same work. There can seldom be any justification for this procedure.

"There is naturally a wide variation in secondary explosives costs, ranging from practically nothing in laminated stone and large equipment to as much as 1c. per ton in some lime plants operating in the typical massive tough

stone common to some localities. This means a ratio of 20 to 25 per cent. of primary costs, and while it may not be out of line for this type of operation, it should merit some careful study.

"Most secondary shooting is done with cap and fuse chiefly for economy reasons, a cap and 3-ft. of fuse costing about 3c. compared to 5½c. for a 4-ft. electric exploder. The former requires more care in handling, however, and some attention should be given to the suitability of the fuse as to burning speed and water resistance. Here again the most economical may not be the lowest in first cost. In this connection there has recently been a notable tendency, especially in some of the larger operations, to use the electric method for all secondary shooting, the extra cost being justified by a reduction in the time lost by the quarry workers while the shots are being fired, and also by the increased safety of this method over the cap and fuse."

Victor J. Azbe, consulting engineer, told of doubling the capacity and cutting almost in halves the fuel rate on some old kilns of the Peerless White Lime Co. at St. Genevieve, Mo., since 1925. The original capacity of two producer-gas kilns built at that time was 40 tons, and in 1920 the fuel ratio had been 2.52 to 1. The capacity is now 80 tons and the fuel rate nearly 5 to 1. In the upper level the gas is introduced through the side walls. In the lower level it is introduced through a central 24-opening burner in the middle of the shaft. These kilns are producing over 1 ton of high-calcium lime per sq. ft. of shaft area. A modern kiln of this design could, in Mr. Azbe's opinion, produce 100 tons daily, with less height, less steel, less brick-work, less concrete, and for less money than is possible with the 40-ton kiln of 1925. A 1,000-ton plant consisting of a battery of 100-ton kilns is a practical possibility, he thinks.

In Mr. Azbe's opinion the cheapest kiln per ton of capacity is that of the Paul Lime Co. at Douglass, Ariz. It is also, he says, the most efficient. The cost of the kiln is approximately $150 per ton of daily capacity, and the interest and depreciation charges are less than 10c. a ton. The Paul kiln is 12 ft. in diameter and has a shaft area of 51 sq. ft. Its total height is 44 ft. due to limiting conditions. The shaft is straight and has no storage zone. The stone is normally 4 in. in size with a maximum of 6 in. The normal low-draft production is 40 tons, but the potential capacity is 50 tons or approximately 1 ton per sq. ft. of shaft area, as in the case of the Peerless kilns. The fuel used is natural gas. The central burner provides eight streams of gas in eight different sections of the shaft, each stream being separately controlled. A comparison of the Paul kiln with that of the Glencoe Cement Co. at Glen Park, Mo. is given in the following table.

		Glencoe	Paul
Capacity	*tons per day*	55	50
Kind of lime		High-calcium	High-calcium
Size of stone		Medium to large (Avg. 6 in.)	Medium (Avg. 6 in. minus 6 in.)
Fuel		Natural gas	Natural gas
Fuel value	*B.t.u.*	980	1,120
Firing method		Center burner	Center burner
Draft		Induced	Induced
Shell size		14'2"x12'8"	11'x13'
Burning-zone area	*sq. ft.*	56	51
Total height above floor	*ft.*	72.00	46.75
Total height above discharge	*ft.*	66.00	43.75
Shaft height	*ft.*	37.50	31.75
Storage-zone height	*ft.*	19.50	None
Cooler depth	*ft.*	14.00	12.00
Shaft space	*cu. ft.*	2,220	1,600
Active kiln space	*cu. ft.*	2,758	2,018
Storage-zone space	*cu. ft.*	1,950	None
Total kiln space	*cu. ft.*	4,709	2,018
Cooler space	*cu. ft.*	538	418
Foundation, cubical mass of concrete and masonry above floor	*cu. ft.*	1,478	529
Kiln, cubical mass of masonry only above foundation	*cu. ft.*	5,134	2,726
Total cubical mass	*cu. ft.*	6,612	3,255
Ratio of kiln mass to active kiln space		2.4 to 1	1.6 to 1
Kiln mass per ton of capacity	*cu. ft.*	120	65
Lime per day per sq. ft. of shaft area	*lb.*	1,965	1,960
Lime per day per cu. ft. of active kiln space	*lb.*	40.0	48.0
Lime per day per cu. ft. of total kiln space	*lb.*	23.4	48.0
Lime per day per cu. ft. of kiln structural mass	*lb.*	15.5	30.7
Cooler	*tons of equivalent lime*	16.0	12.5
Shaft space	*tons of equivalent lime*	66.0	48.0
Weight of lime in cooler and active kiln space	*tons*	82.0	60.5
Time of travel through active zone	*hours*	35.8	29.0
Gas consumption per ton of lime	*cu. ft.*	5,200	4,117

The Paul kiln has a recording gas meter, a duplex draft gage, an indicating pyrometer and valves and levers so that the operator can adjust the gas and the draft and, if need be, start or stop the fan without moving from the spot.

The gas consumption is 4,117 cu. ft. per net tons of lime. If one takes into account only the heat that a lime kiln could utilize then this kiln's efficiency is 81 per cent. The former gas consumption was 6,200 cu. ft. per ton. The capacity was increased from 18 to 50 tons. The lime was greatly improved by reducing the amount of core and the amount of burned lime. Sorting of the lime on the floor has been eliminated.

According to Mr. Azbe, experimentation has shown that five requirements must be met if spalls are to be properly burned.

1. The stone should be properly sized so it will not create an unusual resistance to gas flow.

2. The kiln must be so arranged and equipped that a strong draft can be obtained in the kiln top for drawing the gases through the hot and preheating zones.

3. In addition, air must be also blown into the cooler against the lime resistance and delivered at the gas-entrance points of the kiln.

4. The kiln arrangement must be such that gas will be able to distribute itself to all parts of the kiln cross-section.

5. The kiln must be also so arranged that lime can be drawn at will from any section of the shaft.

"To violate any of these requirements either means a complete failure or inferior result and strangely the first, second and third of these five items are not as important as the last two," said Mr. Azbe.

"It was found, for example, that even though the stone is not sized and if it is just random spalls forked up from the quarry floor, results still will be obtained, although the capacity of the kiln will suffer. It was also found that even with poor draft of only 2 or 3 in. for a spall kiln, results also will be obtained although in this case also, capacity will suffer.

"What, however, must be in no way violated is gas distribution. The required flame penetration must never be more than 10 or 12 in., if this requirement is not satisfied, with small rock one is likely to have an intensely hot spot at one point and a foot away one comparatively cold and blank.

"The fact that horizontal flame penetration in an ordinary kiln commonly is from 2½ to 4 ft. condemns any such kiln as a spall calciner. Along the same line the fact that vertical kilns can be made to calcine spalls is entirely due to the center burner by virtue of the fact that it reduces the necessary flame penetration to the required distance of less than 1 ft."

In discussing Mr. Azbe's paper, Dr. Oliver Bowles, assistant chief engineer, Nonmetal Economics Division, U. S. Bureau of Mines, said that the cost of the small-size stone wasted by lime manufacturers because of their inability to utilize it in their existing kilns constitutes a great loss to the lime industry. He stated that in 1936 questionnaires returned to the Bureau of Mines by lime producers justified the conclusion that about 1,650,000 tons of fines was produced by the lime industry in that year. He referred also to an Ohio quarry which has a waste pile of approximately 100,000 tons of stones less than 4 in. in size and consisting of typical high-grade Ohio dolomite averaging from 98 to 99 per cent. total carbonates. In discussing the best ways of overcoming this loss, Dr. Bowles said:

"The difficulty of burning small stones in the shaft kiln is well known to all operators. The smaller fragments fill the voids between the larger pieces and the draft is so retarded that combustion is incomplete. Furthermore, the carbon dioxide which is generated in large quantities, if not removed at once, builds up partial pressures and, as the fragments of stone are surrounded by an atmosphere of carbon dioxide, a state of equilibrium is reached that makes it impossible for the limestone to dissociate further, and the production of lime stops.

"While studying this problem in 1923 the thought occurred to me that if the small stones were graded carefully to uniform sizes, it might be possible to burn them successfully in shaft kilns. The basis of this theory was the well-known mathematical fact that the voids between spheres are the same irrespective of the size of the spheres, provided they are of uniform size. In other words, the void space in a box filled with 2-in. spheres is the same as that in the same box filled with 8-in. spheres. In discussing this problem with my good friend, W. E. Carson of the Riverton Lime Co., we decided to try an experiment, and we demonstrated in a few minutes that the rule holds for irregular fragments of stone, for we found that the void space between fragments of a ton of 1-in. to 2-in. stone was approximately the same as between fragments comprising a ton of 4-in. to 8-in. stone. With this principle in mind attempts were made to burn uniformly-sized small stone at Rockland, Me., where I had another good friend, George B. Wood of the Rockland & Rockport Lime Co., but the results of the tests were disappointing. Carefully-sized 3½-in. stone was used in a gas-fired kiln, but the draft was so retarded that successful calcination was not attained. The failure was attributed to the fact that, although the air space was as large as when one-man stone was used, the surface exposure of the small pieces was many times that of the larger pieces, and the frictional resistance of the gases passing among the small stone fragments was correspondingly increased. As the channels for the passage of the gas between the stones became small and tortuous, the constant change in the direction of the air currents increased the retardation greatly. Careful sizing of small stone was not, therefore, a solution of the problem."

He referred to the use of rotary kilns as a means of utilizing spalls in the following words:

"The rotary kiln is the most widely used equipment for burning spalls. Large lime plants may have a series of shaft kilns for burning lump stone and a rotary kiln for utilizing the fines. Rotary kilns are undergoing constant improvement and some lime plants use them for their entire output. At such plants the problem of fines is solved. The chief objections to the rotary kiln are: (1) the high cost of installation, and (2) the low fuel ratios. The latter, a few years ago, ranged from 2.75 to 3.33 lb. of lime per lb. of coal equivalent in gas-producer kilns. The latest types, such as the 400-ft. kiln at the Chemical Lime Co. plant, Bellefonte, Pa., and the 290-ft. kiln at the H. E. Millard plant, Anneville, Pa., may attain higher efficiencies. For the smaller companies, however, equipment less costly than the standard rotary kiln must be used.

"The utilization of spalls is, therefore, a serious problem with many lime producers. The waste of 1,000,000 tons a year of high-grade stone is deplorable from the standpoint of conservation of our resources and, furthermore, the fact that the entire cost of quarrying and preparation up to the point of calcination has already been expended on the fine materials makes it highly desirable, from an economic standpoint, to carry out the final step of calcination and thus capitalize on the expenditure already made. The success or failure of many enterprises may, in fact, depend upon the solution of this problem. Some have solved it in part by developing markets for by-products. Fortunately, limestone has a multitude of uses and lime producers commonly find outlets in the form of road material, concrete aggregate, stone sand, agricultural limestone, chicken grit and other products. Such possibilities for profitable utilization should not be overlooked, but they have the disadvantage of requiring new and possibly unfamiliar marketing channels. After all, the lime producer's chief product is lime, he understands its marketing problems and he has the marketing organization already at hand. Therefore, the conversion of spalls into lime is the most desirable solution of the problem."

The speaker referred to a Bureau of Mines report written in 1927 by himself and W. M. Myers in which the design of a kiln such as Mr. Azbe described was quite accurately forecast.

"The draft could be augmented by a combination of interior inlets for gas and mechanical exhausts for removing the products of combustion. If gas were supplied through interior inlets at different levels in the kiln, part of the resistance to the draft could be avoided and enough fuel for combustion brought into the interior of the charge. The introduction into the upper part of the kiln of flues at different levels, arranged to project directly into the charge of small stone, should increase the draft considerably, particularly if the flues were connected with a powerful exhaust fan."

J. K. Billings, superintendent of the Peerless White Lime Co., St. Genevieve, Mo., spoke of the results obtained there through the use of the improved kiln described by Mr. Azbe. He said in part: "In 1919 flat grate production was for 50 sq. ft. of kiln shaft area 10 tons in 24 hr. With the adoption of the semi-producer shortly after this the capacity was increased to about 18 tons. . . . All the kilns up to this time were on natural draft. Entirely as an experiment one kiln was covered and an induced-draft fan applied. The results were far beyond expectations; the tonnage increased to 25 immediately; and later, with the elimination of the semi-producers and the substitution of producer gas from an automatic producer, a tonnage of 30 tons of lime for 50 sq. ft. of kiln area was realized.

"Although it seemed for many years that the large kilns were built unnecessarily high (107 ft. from the foundation to the top of the skip-hoist head frame) and that the storage hoppers were exceedingly large, it has been found that this apparent waste of money in steel and brick was justified, for as tonnage increased it was necessary to diverge from the original form of operation, that of charging only in the daytime, to a plan of filling the kilns after each draw through the entire 24 hr. of the day. If the kilns had not been built so high, it would have been impossible to obtain the tonnages which Mr. Azbe has mentioned. Not only has the 24-hr. charging method made large tonnage possible, but it has made possible a uniform flow of lime through the kiln, which maintains not only chemical but physical uniformity, which latter is becoming more and

more important each year. . . . In our case we try to carry at least a full draw of lime ahead in the kiln. This allows in the case of our big kilns a finishing zone in which much core, which otherwise would be left in the lime, is burned out. Core percentages on these large kilns is about 2 to 3 per cent., which we consider nominal.

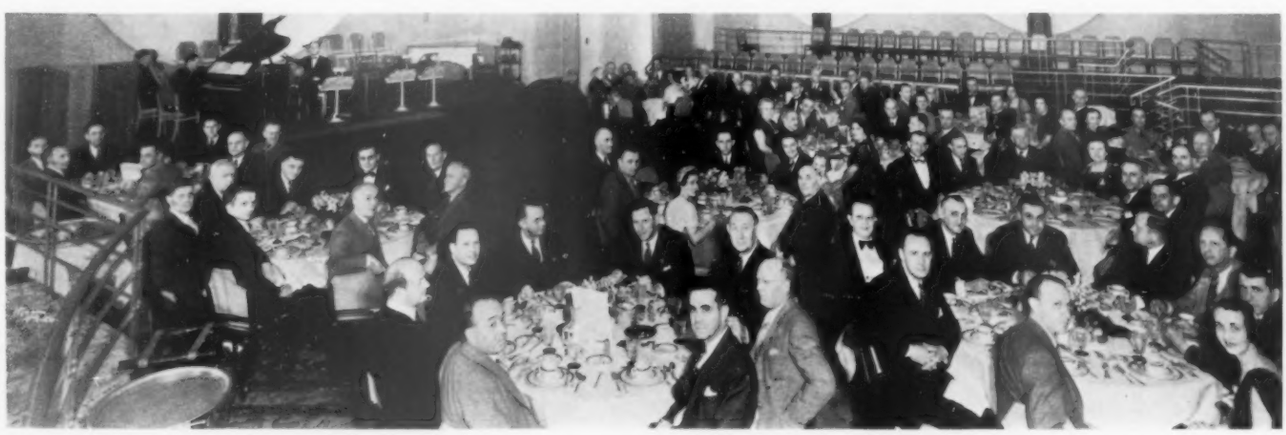
"Induced draft has two very important advantages: (1) as has been shown, that of increasing capacity far beyond any that might be obtainable with natural draft; (2) and by no means the lesser, that of increasing tons of lime produced per kiln per lining. Sufficient draft may increase the life of a kiln. . . . Not only did increased draft cause further heat penetration into the shaft and over a much larger shaft area, but it kept the extreme high temperature in the shaft instead of in the fire arch, and, as we all know, the arch is the heart of any kiln structure. Kiln life actually increased almost in proportion to tonnage. Another thing in kilns operated on producer-gas; draft has an added importance in that gas-main pressures as a rule, and certainly in the plant with which I am connected, are insufficient to push enough gas into the kiln to maintain high tonnages. It, therefore, becomes the duty of the induced-draft fan to pull the necessary gas into the kiln and, with the center burner principle, also air to support combustion of the gas admitted through the center burner. This latter is of more importance in the kilns burning large stone than in the spall kiln, as it is quite necessary, due to the density of the mass, to put combustion air into a spall kiln under pressure."

The speaker also emphasized the necessity for proper supervision when he said: "Too much can not be said of intelligent supervision of kiln firing and drawing. No matter how well a kiln may be designed, the final balance between success or failure of operation lies in the proper trimming at draw time. It is necessary, to avoid excessive core in St. Genevieve limestone, to operate kilns by the 'stick' or 'hang-up' methods. Therefore, a very slight mistake on the part of the kiln puncher may result in rolling the kiln. And in the case of a 75- or 80-ton kiln the resultant loss is considerable. It is therefore of prime importance to have a foreman present at least the greater number of the draw periods during the 24 hr., and this foreman must be equipped with an eagle eye not only to see lime hanging to the kiln wall but his eye must also be an optical pyrometer to judge the heat of his kiln so that sufficient lime will be drawn to avoid slagging of the refractories before the next draw period. He must also be able to judge whether the lime in the burning zone is hard, medium or soft, as his production needs may require. To enable a visual inspection of a kiln, it is first necessary to see into it at not one point but many points, and, of course, it is just as necessary to be able to get at any and all places in the shaft with a punch rod. Effective punching is never accomplished with short rods. In other words, in our large kilns 20- to 21-ft. punching rods are used, enabling a kiln puncher to reach from one end to the other of these shafts, which are 7 ft. by 12 ft., and to thoroughly clean the upper side arches, the side walls, and the ends. These kilns have 20 poke holes extending from the operating floor almost to the kiln top, and all of them are used, possibly not at all draw periods but on occasions we find it necessary to use the upper punch holes when limestone arches in the storage zone. If this were not done religiously every 4-hr. draw period, the kiln's life would be greatly shortened and, in consequence, costs and operating curves would suffer.

"In producer-gas fired kilns to maintain high tonnage and uniform gas input to the kilns, it is necessary to keep all the gas mains clean and free from soot and tar. In our operation all the necks from the gas main and the inlets to the kilns, either side fire arches or center-burner ports, are blown out with compressed air every 8-hr. shift. This does not delay or retard production, as the blow holes are placed in convenient places and the blowing is done with gas pressure on the main. The gas main itself is cleaned once a week in a rather novel manner. It is about 259 ft. in length and a piece of double-strength pipe, mounted on cast-iron rollers and on the front of which is a nozzle, is pushed through the flue by means of a small steam engine. The air pressure (100 lb.) dislodges the soot and the expended air supports combustion so that when, after one pass, the blower is withdrawn the main is as clean as a new pin. This operation is necessary only once a week and requires approximately 1½ hr."

Several hundred architects, engineers and building officials responded to the lime association's invitation to attend a luncheon and to listen to a talk on *Why Masonry Walls Leak* by Prof. Voss. This was the same address which he had previously given at numerous similar meetings throughout the country. It was devoted principally to the display of a series of 37 stereopticon slides illustrating partly by microphotographs the behavior of different kinds of mortar exposed to weathering conditions for different periods of time up to 187 years. These microphotographs, which represented various magnifications from 60 to 280, showed how the use of lime in mortar furnished a material which nature could use as a protective coating in sealing up the spaces through which water can pass. His demonstration was prefaced by a discussion of the attitudes of the owner, the architect, the engineer, the builder, the tradesman and the materials manufacturer and dealer toward leaky walls and their respective responsibilities.

The discussion was highly informa-



Photograph taken at the annual banquet on the evening of May 10.

tive and provoked a number of questions which indicated the deep interest of the listeners in the leaky-wall problem. One of these questions dealt with masonry cement, to which Prof. Voss replied in these words:

"When you say masonry cement, you do not tell me a thing. They are of all shades and compositions. There are straight natural cements, slag cements, and mixtures of cement, lime, waterproofings, and many other admixtures. I would like to see every bag of masonry cement carry on its container the composition by weight, the proportions of Portland cement, natural or slag cement, lime, waterproofings, and so on. They can not be substituted at random for Portland cement, as you can readily see. What do I think of masonry cements? I may think them satisfactory and then again, knowing their composition, I may consider them unsatisfactory. There are only two major cementitious matrices. One is calcium silicate or related compounds, and another is lime in some form or other. To me cement should be one of the former, and lime is one of the latter. Personally, I would prefer to use these basic materials and mix them myself under supervision or receive them in properly-marked bags as suggested above."

He startled his hearers by stating that bricks should never be wetted before being laid. On this subject he said: "It is probably heresy for me to say, 'Never let a hose or drop of water touch even your common brick. Lay them dry, any time.' Let me explain. During hot, dry weather the brick is as large as it will ever be due to temperature expansion. When you wet such a brick then it becomes as large as it ever will be due to water expansion. These two expansions are cumulative. The following winter the brick is as short as it will be due to low temperatures and as these nearly always are accompanied by low humidities, the brick is as short as it will be due to moisture. There is, therefore, only one answer. The head joints have to open up. Scientifically it is wrong to wet brick in the summer time. In all of these remarks I am, of course, speaking of bricks with an absorption between 5 and 10 per cent. which are laid in a mortar having a high lime content."

Asked for an ideal specification for mortar for brickwork, Prof. Voss replied, "May I be permitted to answer this question in relation to the masonry unit? Face bricks shall have limits of absorption between 5 and 10 per cent. Common brick backup should not exceed an absorption of 15 per cent. It is also assumed that all joints are filled and the face joints properly pointed. Under these conditions a general average mortar would be 1 part of Portland cement, 1½ parts of lime solids in the form of putty (about 2 parts of usual slaked lime putty), and from 6 to 7 parts of sand (depending upon its graduation). Cement is necessary for its strength, while lime is necessary for workability and the other actions already discussed."

In answer to a question regarding the value of lime as an aid in waterproofing concrete the speaker said, "May I answer this question by giving you my definition of concrete? It is a heterogeneous mixture of all shapes and kinds of bricks dropped into the wall with a sloppy, high-cement mortar. Does that mean anything to you, in the light of my discussion of the problem of brick walls? Under every piece of coarse aggregate is a little half moon of water. That water evaporates, and as the surrounding cement gel loses its water it cracks, and access is provided to these half-moon voids. If water penetrates these voids, and it certainly does, movement results, and the bond contacts gradually are broken. If the stone is dense or very wet, there is no suction, and we have the same phenomenon as for brick joints. For these reasons we have experimented with lime substitutions for cement and find that the use of about 7 lb. of lime solids per bag of cement will not decrease the strength and will give us all the characteristics which lime imparts, namely, workability, plasticity, and subsequent 'building-in.' There are those who say that the leakage in concrete causes the leaching out of lime. This is true at cracks, construction joints, and at honeycombed areas. Leaching is not evident, however, between such cracks. This very thing indicates that lime is carried by water and if it can be deposited in cracks which have no openings for a direct flow, it will carbonate in these cracks and build-in the voids."

Another question touched the use of quarry sand, to which the professor replied by stating, "I have no objection to the use of manufactured sand in place of natural sand. Nature made the usual sand. It is usually siliceous. You made your own sand. It may be a carbonate of some kind. I like limestone sand simply because it acts as a catalyst in prompting the formation of calcium carbonate from the lime in the matrix."

Walter H. Tomlinson, assistant engineer of the U. S. Bureau of Mines, in discussing *Stimulating Interest in Safety,* gave the following information about the accident-prevention campaign among lime producers last year:

"The results of the third yearly accident-prevention contest among quarrying companies engaged in the manufacture of lime have just been determined by the Bureau of Mines which conducted the contest in cooperation with the National Lime Assn. Thirty lime plants participated in the contest and, of this number, 6 were operated during the contest year, 1937, without an accident causing disability to an employee. Certificates of honor were awarded to these 6 plants in recognition of their success in keeping their records free of accidents during the year. In addition to the winners of the certificates of honor, 7 other plants had only one accident each.

"The combined accident-frequency rate for the 30 plants was 22.5 for each 1,000,000 man-hr. of employment or exposure of the employees to hazards incident to their occupations. This rate was slightly higher than the group rate of 21.1 for the previous year. Accidents during 1937, however, were somewhat less severe than those in 1936, as the accident-severity rate per 1,000 man-hr. of exposure to risk was 2.98, compared with 3.54 for 1936. The average accident, including specific charges for deaths and permanent disabilities, represented 133 days of disability in 1937, indicating an improvement from the average of 168 days of disability per accident in 1936.

"The 30 plants that participated in the 1937 contest worked a total of 5,292,013 man-hr. In the performance of this work the plants had two fatal injuries and 117 nonfatal injuries. The total number of days of disability charged to the injuries was 15,774. Although all the accidents occurred at 24 plants, the figures represent an average of over 500 days lost from injuries for each of the 30 plants taking part in the contest. This is in itself, from both employer and employee point of view, ample reason for a well-organized safety program at each operating plant, in view of the possible relation of the average loss per plant in an industry and the accident insurance charges that the industry must pay.

"The 6 plants winning safety awards for establishing accident-free records during 1937 were active for nearly 1,000,000 man-hr. The plants winning the awards were:

"Bell plant, Bellefonte, Pa., operated by the American Lime & Stone Co. This plant was in operation 397,493 man-hr. in 1937 without a lost-time accident.

"Galloway plant, Galloway, Mo., operated by the Ash Grove Lime & Portland Cement Co. This plant was in operation 252,979 man-hr. in 1937 without a lost-time accident.

"Thomasville plant, Thomasville, Pa.,

operated by the J. E. Baker Co. This plant was in operation 99,347 man-hr. in 1937 without a lost-time accident.

"South Chicago plant, Chicago, Ill., operated by the Marblehead Lime Co. This plant was in operation 97,347 man-hr. in 1937 without a lost-time accident.

"Springfield plant, Springfield, Mo., operated by the Marblehead Lime Co. This plant was in operation 92,480 man-hr. in 1937 without a lost-time accident.

"Houston plant, Houston, Tex., operated by the Haden Lime Co. This plant was in operation 31,561 man-hr. in 1937 without a lost-time accident.

"Of the 30 participants enrolled, 20 have taken part since 1935, when the yearly contests were inaugurated, and 25 plants were entered in both 1936 and 1937. The following is the record of the 25 identical plants for 1936 and 1937.

Year	Man-Hours	No. of Accidents	Days Lost	Frequency	Severity
1936	4,871,387	97	18,350	19.912	3.767
1937	5,024,483	107	15,721	21.296	3.129

"The principal causes of the accidents occurring during 1937 were handling rock and other materials, hand tools, haulage, burns (including lime burns), and falls and slides of rock or overburden. Excluding the two fatal and three permanent injuries, the causes of accidents resulting in the greatest severity per accident were those from falling objects, falls and slides of rock or overburden, haulage, and machinery."

Diesel Engines in Industry was the subject of an interesting paper by T. M. Robie, manager of Diesel sales of Fairbanks Morse & Co. After reviewing the development of the Diesel engine and the change of attitude towards it, he described some of the practical problems involved in Diesel-engine purchase and operation. On the subject of size he said, "The development has grown both ways. In the smaller sizes the automotive influence has been felt, so that to-day we have full-Diesel engines with bores of 3 in. operating at speeds up to 3,000 r.p.m. Obviously the precision machinery required to build such an engine was not dreamed of twenty-five years ago. At the other end of the scale we have marine and stationary Diesels up to 10,000 hp. as no longer news items, and a few units up to 30,000 hp. in service abroad."

The cost of Diesel-engine power is one of this type of engine's chief advantages and a point in which all potential Diesel-engine users are intensely interested. Mr. Robie had the following to say on this subject:

"The Diesel engine from the start has operated on a most efficient cycle but it has been possible to lower considerably the specific fuel consumptions, so that now it is not unusual to find comparatively small units developing 1 hp.-hr. on less than .40 lb. of fuel. This (0.40 lb. per hp.-hr.) corresponds to a thermal efficiency of 33.5 per cent., a figure seldom equalled even in the large central-station steam-turbine plants.

"The ability of small units to generate power as cheaply as their larger brothers has an important bearing on the use of Diesels in industry. Few new plants are static in the matter of size. With Diesel power, however, efficient units may be installed initially and as the plant grows additional units may be purchased without affecting the operating economy. This is an advantage from both an investment and operating standpoint because if an engine, larger than originally required, had been installed at the beginning based on anticipated load, it might have had to operate several years at low load factor before the plant grew up to it. Low load factor would mean higher cost per developed horsepower as well as a greater investment charge.

"There is an added advantage in having more than one unit in the average industrial plant, because the load is not always constant, and by having two or more units they may be fitted to the load requirements so that each operates under the most efficient conditions. Here, again, the fact that small units will operate as efficiently as larger ones is an advantage enjoyed only by Diesel power.

"In the early days of the Diesel its opponents made much of the predicted short life. Operating records from hundreds of plants have disproved these statements, so that to-day, where necessary for accounting purposes, a life of 20 to 25 years is set up. The wearing parts of a Diesel are renewable, so that, except for obsolescence, it should be possible to run an engine indefinitely. We have frequent cases where fuel consumptions are checked after 5, 10 or 15 years of operation and are found still to meet or better our original guarantees. The matter of obsolescence has been largely overcome by our engineers by so designing the new improved parts that they may be applied to engines already in service. As a result of these efforts, we have engines installed ten years ago, fitted with improved present-day production parts at a cost well justified by the better engine performance."

The speaker considers dust one of the most serious problems to be faced by Diesel-engine operators. He said, "Probably the worst of all conditions interfering with successful operation is abrasive dust in the air. If we consider that the air drawn into a 450-hp. 6-cylinder 14-in. by 17-in. engine turning 300 r.p.m. amounts to over 2,000 cu.ft. per min. or the space of a room 10 ft. by 20 ft. by 10 ft., we can get an idea of the importance of having clean air. Fortunately, suitable air-filters have been developed to eliminate effectively these dust particles and the resultant wear is greatly reduced. Since there is always more or less dust in the air, it is recommended that air-filters be used in every industrial Diesel plant.

"Another condition deserving careful consideration is the matter of fuel storage. Refineries take extreme precaution to produce a clean, suitable fuel, which all too often is placed in dirty containers or is allowed to become contaminated with water. Diesel manufacturers have learned to protect themselves against such conditions by placing filters in the fuel lines to the engine, but sometimes even the cleaning of these is neglected. Clean fuel for Diesels is just as important as clean gasoline for our automobiles. It should be needless to add that clean lubricating oil is as essential as clean fuel.

"It is surprising that the cooling water for Diesel installations was given so little attention in the early days of the industry. Steam engineers had experienced the trouble due to scaling and the need for suitable treatment, yet this was given little thought by Diesel engineers. As a result water jackets became encrusted with heat-insulating scale, which, if not removed, sooner or later caused cracked cylinder heads or scored cylinders. The first attempt to correct this condition was to treat the cooling water chemically and use a cooling tower. This was effective provided the water in the system was checked regularly. Even though the make-up water was reduced to a hardness of only a few grains, it was not long before the evaporation in the cooling tower had concentrated the hardness of the water in the system to a point where it again caused trouble. Where such an arrangement is in use, provision should be made to divide the system, so that the water can be batch-treated to offset the concentration of scale-forming ingredients.

"Another system which is now generally in favor is called the 'closed system' and consists of a heat-exchanger unit. The engine cooling water is suitably softened and circulates only through the jackets and the heat exchanger. It is cooled in the latter by raw water from a cooling tower or other available source. With this system

there is practically no evaporation loss and scale troubles in the engine jackets are eliminated.

"Pyrometers have become almost universally used on multicylinder units. They measure the temperature of the exhaust from the individual cylinders and enable the operator to balance the load properly.

"The above points represent about all the precautions necessary to give a dependable, long-lived, economical plant, and are worth summing up briefly:

"Fit the engines to the load.

"Provide air-filters to remove abrasive dust.

"Keep fuel and lubricating oil clean.

"Use a closed cooling-water system to prevent scale formation.

"Provide pyrometers to check engine operation.

"If the above points are followed many years of dependable service may be expected.

"The many applications of a Diesel as related to the lime industry are worthy of mention. Diesels are widely used in shovel and dragline operation so that your raw material could be Diesel produced. A 2-cu.yd. shovel operating in rock would require a Diesel of approximately 150 to 175 hp. and under these conditions would consume about 5 gal. of fuel per hr. These figures are actual average for a check period of nearly 1,000 hr.

"From the pit the material could be transported to the crushing plant by either a Diesel truck or a Diesel-powered industrial locomotive. A 10-ton locomotive would require about an 80-hp. Diesel.

"The crushing plant might well be operated with a heavy-duty stationary Diesel, either with a direct drive to the mill machinery or a combination direct and electric drive, or a full-electric drive. Definite recommendations would be dependent on the particular plant lay-out.

"The finished material from the plant must be loaded into railroad cars or barges and here again Diesel operated equipment is available for economical operation. A 25-ton locomotive crane could be used to advantage. This would be powered with a 100 to 125-hp. Diesel and would normally burn about 2 gal. of fuel per hr., these figures again based on actual performance.

"While the freight train can not yet be pulled out with a Diesel locomotive, as these so far have been limited to passenger service, still if a river is handy the material can be shipped with a Diesel-propelled towboat."

The speaker showed the following comparison of the cost of Diesel power steam power and purchased electric power.

Cost Comparison (300 days at 10 hours per day)—

Diesel Cost:	Cost per Hp.
Fuel at 5 c. per gal. Consumption .40 lb. per b.hp.-hr.	$ 8.30
Purchased Power Cost: Motor efficiency 80% Cost per kw.-hr. 2 c	56.00
Steam Cost: Coal, 0.4 lb. per hp.-hr. at $5 per ton	30.00

"The above are fuel costs only and to them should be added the cost of labor, maintenance, lubricating oil and miscellaneous supplies, which will vary depending on the particular installation.

"The question is frequently asked regarding the distribution of Diesels. A recent issue of *Diesel Progress* shows the following installed horsepower as of 1937:

Tractors and other mobile equipment	2,600,000 hp.
Marine, Navy and Coast Guard	2,300,000 hp.
General industrial uses	1,800,000 hp.
Public utilities	1,000,000 hp.
Petroleum industry	1,000,000 hp.
Municipal power and light	800,000 hp.
Exports	400,000 hp.
Railroads	300,000 hp.
Quarries and mines	250,000 hp.
Ice plants	200,000 hp.
Cotton gins	200,000 hp.
Irrigation	200,000 hp.
Government buildings	200,000 hp.
Water works	175,000 hp.
Total	11,450,000 hp.

The use of *Lime in the Treatment of Sewage and Industrial Wastes* was the subject of a paper by Willem Rudolfs, chief, Division of Water and Sewage Research, Agricultural Experiment Station, New Brunswick, N. J. He started by saying that sewerage facilities have been provided for approximately 72,000,000 people in the United States and that of these about 37,000,000 now discharge partially or completely treated sewage into bodies of water. Five years ago there were about 2,900 station treatment plants and this number has grown to approximately 3,700.

The purpose of all sewage and waste treatment processes is first to precipitate the suspended solids from the liquor and dispose of the resulting sludge and stabilize the liquor so that it can be discharged into a stream without polluting it unduly. About 0.02 per cent. of the sewage is in the form of suspended solids, half of which can be settled out by retaining the sewage in concrete tanks or basins for a period of 2 hr. After this the sludge is digested and then either destroyed or dewatered. The liquor is often stabilized by spraying it into the air, or air is blown through the sewage. Treatment with chlorine kills the surviving bacteria. Lime is used in conjunction with other chemicals to aid in the removal of the suspended matter from the water in various coagulation processes. These require from 150 to 900 lb. of hydrated lime per 1,000,000 gal. of sewage, the usual amount ranging from 300 to 600 lb. Thus a city of 50,000 people uses from 1,500 to 3,000 lb. of lime a day or from 250 to 500 tons of hydrated lime a year.

In the digestion portion of the sewage-treatment process the chemical reaction which takes place can be controlled most easily and economically by the use of hydrated lime. Caustic materials are detrimental, unslaked lime is dangerous to use, and caustic soda kills the bacteria, which are needed to produce acidic intermediate compounds and combustible gases. The gas-forming bacteria work best in a slightly alkaline environment, so that the acidic compounds must be neutralized. It is for this purpose that hydrated lime is used.

In the dewatering of the sludge chemical processes are winning favor because rotary vacuum filters with suitable conditioning chemicals have proved the most effective. Hydrated lime is used here to save costly chemicals. The quantity required ranges from 150 to 300 lb. per ton of dry solids. The addition of 6 to 12 per cent. hydrated lime on the basis of dry solids with suitable coagulants decreases the moisture content of the cake, which can then be used for several purposes. Where the sludge is used as a soil builder or as a filler to be used with artificial fertilizer, suitable coagulating chemicals are used in conjunction with lime. For this purpose 40 to 50 tons of lime a year are needed for treating the sewage of about 30,000 people.

In discussing the use of lime in the treatment of industrial wastes, Mr. Rudolfs said:

"Acid iron wastes and acid mine drainage waste can and are treated to some extent by neutralizing with lime. For the clarification of beet-sugar wastes large amounts of lime are used, amounting to as much as 10,000 lb. of lime per 1,000,000 gal. of waste. In the treatment of canning wastes the amount of lime varies from 6 to 10 lb. per 1,000 gal. of water, when suitable coagulants are used. In coal washing lime is used in conjunction with other chemicals. The treatment of creamery and dairy-products wastes has been studied intensively. In all the processes proposed and utilized considerable quantities of lime are required, varying from 4 to 10 lb. per 1,000 gal. for clarification with proper coagulants, and considerably more when the sludge and liquor must be treated further. Some distillery and brewery waste has been treated in part with the aid of lime. Dye-houses and textile-factories make use of acids for

clarification and lime for neutralization of the wastes before discharge. In handling other waste liquids from dyeing, scouring, bleaching, etc., lime, alone or in conjunction with coagulants, is used. In the food industries the addition of lime to the waste to make further treatment possible is helpful. Laundry wastes are adjusted with lime before treatment with coagulants and then again treated with lime to produce proper settling and clarification. In packing-house waste treatment from 600 to 1,300 lb. of lime is used, together with suitable coagulants to remove about 75 per cent. of the suspended material present. In treating paper-mill wastes balanced coagulants with lime or calcium carbonate are used. For treating strawboard waste a combination of carbon dioxide and milk of lime is effective, when properly applied. Tannery wastes may be treated with lime sludge coming from the dehairing vats. In tannery and wool scouring, where acids are used, lime is required for neutralization. There are many other places where lime could be used to advantage, but, in spite of recent advances in industrial-waste treatment, satisfactory and economical methods of treatment are pressing problems in the pollution abatement field. This is particularly true in connection with the protection of aquatic life in our inland and coastal waters. This aquatic life is necessary if the streams and water-courses are to perform their functions of self-purification. Recent research indicates that industrial wastes are possibly the major hazards to aquatic organisms, because relatively small quantities of waste produce profound changes in the chemical balance of dissolved substances found in natural waters. In this respect it is of interest to note that, if some of the trade associations would spend as much money for the investigation and development of methods of treating and recovering trade wastes as they spend in fighting legislation for the control of stream pollution, more and better results would be gained.

"The field of sewage and trade waste treatment is just beginning to open. Large quantities of lime can be used. The present use of lime has come through research and investigation conducted nearly entirely outside the lime-manufacturing industry. Either the lime manufacturers did not think there was a substantial market, or they felt that a customer using only a few hundred tons of lime a year was not worth cultivating. It would seem to me that with proper research, stimulation and going after the business the sale of lime in sewage and waste treatment can easily amount to some 300,000 to 400,000 tons a year."

At the concluding session of the convention S. Walter Stauffer was reëlected president and general manager of the association. M. V. Brumbaugh was reelected secretary and assistant treasurer. J. H. McNamara was reëlected treasurer, and Miss Roma F. Medford was again chosen as assistant secretary.

Help Your Wire Ropes to Last Longer

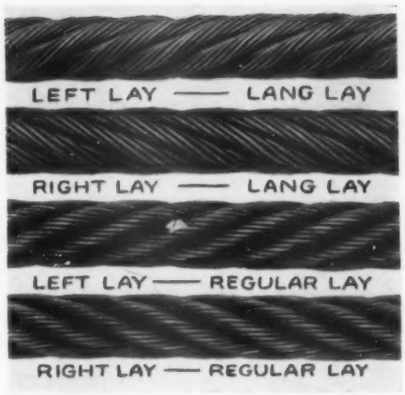
The matter of making wire ropes last longer is a matter of using the right ropes in the proper way. Certainly, it is true on the face of it that the proper use of wire rope will assure longer rope life. It is just as true, though not as obvious, that the selection of the correct ropes for given duties will result in better rope service.

The job of specifying a wire rope must begin with an understanding of the conditions under which the rope must work. Abrasive and corrosive influences must be recognized. Forces that promote bending fatigue must be seen. Abrasive operating conditions must be taken into consideration. Many practical considerations must have their effect in determining rope specifications.

In general an abrasive condition is best met by a Lang-"lay" rope of tough material and of a construction that provides large outer wires, because in such a rope the abrasion is distributed over a greater area of outer wire surface. It would seem a simple matter, then, to select a rope best suited to withstand abrasion.

But the difficulty is that, as you select tougher materials and larger outer wires you reduce the rope's resistance to bending fatigue. Resistance to abrasion and resistance to bending fatigue vary inversely. You must get a proper balance between the two if the rope is to give maximum service. Nowadays this is not as difficult as it was years ago. There is a way of satisfying these apparently contradictory requirements. That way is to use a preformed rope.

Much of the relatively-lower resistance to bending fatigue possessed by a non-preformed wire rope is due to the internal stresses with which the rope must contend. When a non-preformed rope is bent, the pure bending stress is intensified by the stressed condition of the rope wires. As wire sizes are increased and tougher material is employed this effect becomes greater. When a rope is preformed, internal



Differences between Lang-"lay" and regular-"lay" wire rope. In the former the wires in the strands are wound in the same direction as the strands in the rope, in the latter they are wound in the opposite direction.

stresses are removed. And, so, with a preformed rope it is possible to employ the larger wire sizes and the tougher materials without so greatly reducing the resistance to bending fatigue.

If the application be one in which a Lang-"lay" rope may be used, that Lang-"lay" rope should be preformed. Lang "lay", with all its potential advantages, was never really practical until the art of preforming was introduced. It was too lively, too cranky, for dependable service. Now in a preformed wire rope the user can have the flexibility and abrasion resistance of Lang "lay" without the disadvantages formerly associated with it.

In general the greater the action the rope must undergo, the greater the need for a preformed rope. For example, on a power shovel on which the boom line is relatively inactive, a non-preformed boom line may be quite satisfactory. But the hoist line, which is subjected to continual action, should be preformed.

A preformed wire rope, like any other rope, gives its best service when

Lang-"lay" rope wears uniformly and resists abrasion well. If this rope had been regular "lay," the crown wires touching the sheaves and dragging through the gravel would have been worn through.

it is operated over sheaves of the proper diameter. However, in actual practice many ropes must be run over sheaves of insufficient diameter. In such a case a non-preformed rope suffers much more than does a preformed rope. The fatiguing effect is of much greater intensity.

The coming of the preformed wire rope has distinctly raised the level of wire-rope service. Rope lives have been increased and rope costs reduced by the practical operating advantages that preforming brought with it.

N. I. S. A. Honors Pioneer of Industry; Convenes at His Home City of Zanesville, O.

Edward M. Ayers, president, Ayers Mineral Co., Zanesville, O., was presented with this beautiful glass vase, suitably etched, when his friends, members of the National Industrial Sand Assn. held their annual convention at his hometown and birthplace.

IN honor of Henry M. Ayers, president of the Ayers Mineral Company, Zanesville, O., who celebrated on May 17 the fiftieth anniversary of his marriage to Mrs. Ayers, the National Industrial Sand Assn. held its third annual convention in that city on the 11th and 12th of last month. As a token of their esteem, his friends and associates presented him and Mrs. Ayers with a beautiful glass vase made by Stiles-Milholland of New York after a special design created for the occasion. Those who attended the convention were the guests of the Ayers family at their home at the close of the first day's sessions, after which they gathered at the Headley Inn, which was opened before its usual season on account of the event.

The dust problem in the industrial-sand industry practically monopolized the interest of those in attendance. There were three important papers dealing with various aspects of the subject, and the U. S. Department of Labor's motion picture entitled *The Story of Silicosis* was shown. The first session was opened by the association's president, A. Warsaw, who mentioned the fact that the association's membership represents over 85 per cent. of the production of industrial sand in the U. S. in the 33 producing companies who comprise it. He referred also to the association's work before the Interstate Commerce Commission in the matters of Ex Parte 115 and 123, a subject which was discussed fully by William W. Collin, Jr., member of the law firm of Patterson, Goehring, McClintock & Collin of Pittsburgh, who spoke on the *Representation of the Industrial Sand Industry in Ex Parte 115 and Ex Parte 123 of the Interstate Commerce Commission.* The carriers, as Mr. Collin explained, had asked in their petition filed in November of last year for a 30 c. increase in the freight rates on industrial sand. More than 150 protests on that number of commodities had been filed with the commission, but the latter suspended the increase that had been requested. The suspension carried a "rider" which provided that the carriers were allowed to publish a 20 c. increase in lieu of the 30 c. increase demanded. Various state commissions with whom similar protests had been filed took similar action by way of suspension, those states being Illinois, Indiana, New Jersey, New York, Ohio, Pennsylvania and West Virginia, although they did not attach to their orders the I.C.C. 20 c. "rider."

Theodore Hatch, associate dust-control engineer, Division of Industrial Hygiene, New York Dept. of Labor, presented a paper on *Regulations for Dust Control in the Foundry and Ceramic Industries.* He reviewed the history of dust control in New York State and presented some slides showing a record of dust control in the gold mines of South Africa. He referred to the work of the Miners' Preventive Committee which was formed in that country in 1916, and which since that date has been working steadily to improve the silicosis record. From a dust concentration amounting to 20 milligrams per cu. m. in 1909 the amount of dust has been reduced to less than 1 milligram per cu. m. In two years they examined approximately 10,000 men, among whom they discovered annually 373 cases of silicosis. From their results it was shown that on the average 6 years' time was required to produce the first indication of silicosis in one group of men.

He then discussed the New York State code No. 12, which requires that all machinery creating dust, fumes, and gases, should be provided with adequate means of control. This code also provides for adequate ventilation and that ventilation equipment be submitted to the Department of Labor for examination and approval before its installation. During 1937 the Department examined nearly 1,700 plans for ventilation systems, about 35 per cent. of which were disapproved for basic engineering reasons. The department has one committee that is active in the study of dust control in stone-crushing plants; another that is concerned with dust control in connection with rock drilling, tunneling and building excavations; while a third committee covers the foundry industry. Some results of the study made by the last-mentioned committee were shown on slides. A preliminary investigation was made of every foundry in the state. Then a standard questionnaire was sent out dealing with the equipment and the type of control provided, and then X-ray examinations were made of approximately 5,000 men or one-third of all the foundry workers in the state.

The speaker referred again to the South African records when he said that the number of cases of silicosis among miners 30 years old is 30.4 per cent. The results in America agree roughly with this figure.

The *Medical Phases of Dust Control in the Foundry and Ceramic Industries* were discussed by Dr. Roy R. Jones, past assistant surgeon, Division of Air Hygiene of the U. S. Public Health Service. He said in part, "The question comes 'What are the effects of breathing dust? What is the result that breathing dust will produce?' Well, this can be grouped three ways. First, an irritative dust—any organic dust—if it is inhaled, will produce ir-

ritation. In the second group are toxic dusts; for instance, arsenic of lead—that's a class by itself—which may produce irritations but in the end, if the exposure is continued, you can actually have a case of poisoning as a result. Then the third class of dusts, in which the people in the foundries and you sand people are particularly interested, are classed as fibrosis-producing dusts.

On the subject of diagnosis he said, "I have had the question asked me today, 'Can the ordinary doctor diagnose silicosis?' One of the most serious drawbacks to the whole silicosis control program has been that universally over the country the cry went out that you can diagnose silicosis only with an X-ray. Now I think every last man should have this idea firmly fixed in mind: Silicosis isn't necessarily diagnosed with an X-ray. You can't diagnose silicosis without an X-ray, that's true. But the diagnosis of silicosis should always be based upon the same things as any other disease—case history, clinical findings, laboratory findings, all the data at your command. . . ."

"What percentage of people have silicosis? In some investigations you can find 20 per cent. of the fellows with silicosis, as for instance in our anthracite study. From a scientific study of hard-coal miners we found over 23 per cent. with evidence of silicosis. In the study of lead and zinc miners 20 to 23 per cent. were silicotics. In the various investigations that have been carried out in the granite industry 22 and 23 per cent. were silicotics."

E. O. Schneider presented the report of the committee on research and was followed by Stanton Walker, director of engineering, who pointed out some of the subjects in which, in his opinion, research should be undertaken. These included the dust hazard, foundry sands, glass sands, and the accumulation of a library of industrial literature.

In view of the fact that Mr. Walker can not, because of his duties as director of engineering of the National Sand & Gravel Assn., devote enough time to the work of the National Industrial Sand Assn., his title has been changed from that of director of engineering, to consulting engineer. Mr. Walker requested that this change be made inasmuch as his former title, in his opinion, gave an erroneous impression concerning the extent of his activities in the interests of industrial sand.

Theodore C. Waters spoke on *Governmental Regulations Dealing with Occupational Disease Control.* Mr. Waters is the attorney for the National Industrial Sand Assn., and has been active in developing codes for the control of dust hazards in sand plants. He spoke first on some of the aspects of occupational-disease legislation and said,

"Under the present Federal Administration, we have witnessed the enactment of the most extensive program of social legislation in our history. These laws have been far-reaching and have directly affected the business of each of us in this room. Whether we like it or not, a new order exists in our industrial life and, in many respects, the purposes sought to be accomplished by that new order are commendable. The spotlight of publicity has been turned upon the entire relationship existing between employers and employees, and many of the evil practices of the old order are gone, never to return.

"The trend of social legislation in national affairs, to which I have referred, has extended to state governments, with the result that there has been increased state activity affecting your respective businesses. The successful administration of occupational-disease laws will depend in large measure upon the degree of coöperation that will exist between the employer, the employee, and the governmental agencies administering these laws. In the new order we accept the need for this type of legislation, but desire to accomplish its administration in a manner that will be fair and equitable to employer and employee alike. Industry can not and should not attempt to avoid its responsibility for the protection of its workmen from hazards involved in its processes and I know that you gladly accept your legal and moral responsibility for the compensation of those employees who suffer occupational diseases that are caused by the conditions to which they are subjected in your plants. In spite of the perfection of your methods of dust control and the protective devices with which you supply your employees the human element in your operations is always present and, from one cause or another, your employees will continue to be subjected to the hazard of silica. You can install the most effective equipment, supply your employees with the latest protective devices, but you can not altogether protect your workmen from the consequences of their own negligence. . . .

"After you have sold your product to your customers, a new problem is created by their use of your material. Some of them do not have a full appreciation of the hazards to which their employees are exposed, and have not perfected their machinery and equipment to afford their employees adequate protection. Since the problem exists and, despite human effort, will probably continue, it is inevitable that state agencies, charged with the administration of occupational-disease laws, will increase their supervision of those industries engaged in the production and uses of silica.

"I believe that the thought I am trying to express was clearly stated recently by Mr. Lamont, speaking in New York at the annual dinner of the National Institute of Social Science. He made this statement, which, I assume, you have already read and which, I trust, you will take to heart:

" 'We all realize that corporations, both public and private, are in for a greater degree of government supervision, far greater than in the old days. Business men, if they are wise, accept this fact, and they must adapt themselves to the new order.'

"Some of us have been supercritical of the term 'government supervision', and have been antagonistic to any proposal that smacks of government interference with our business life. Yet, I know that at heart each of us recognizes that some good has resulted from these governmental activities, and, with that recognition, we have come to adjust ourselves to the need for coöperation with governmental agencies upon whom is cast the duty of administering these laws. I believe that by such coöperation between industry and government, many of the objectionable features of these laws will disappear, and ultimate benefits to employer and employee will result from their administration."

A vivid picture of *The Political Scene in Washington* was presented by the association's executive secretary, V. P. Ahearn. He discussed briefly legislation which has been either adopted or rejected by the present Congress. On the subject of the agricultural bill, he said:

"I believe that we in industry should not lose sight of the fact that the Agricultural Bill does not refer to agriculture alone. Probably the most effective lobby in Washington is the agricultural lobby. In a great many states the agricultural vote is the backbone of the total vote, and the farmers have had notable success in securing for themselves the most favorable kind of legislation as they saw it. As a matter of fact, the only reason why Mr. Hoover didn't propose exactly the same legislation which Mr. Roosevelt sponsored was that up until that time the farm leaders were not able to get together on what they wanted. I think it is an interesting commentary right at this point to suggest that controlled agriculture is probably a permanent policy of this government. I don't believe any change in political alinements or any shift in proper political success would have any effect whatever on the federal agricultural policy, except perhaps to make it more liberal.

But when I say that industry should not be unaware of the fact that the agricultural bill does not refer to agriculture alone, I mean by that that a constitutional suggestion is made that this government may control the business life of the United States because production is limited and controlled. Of course, it is controlled by subsidiaries but nevertheless the principle has definitely been established as to any phase of our economic life. The government may say by the use of grants and subsidies exactly what you as an individual may or may not do."

He then pointed out the change in the government's attitude toward unfair and deceptive acts in Commerce as shown by the Wheeler-Lee Bill. On this change he said:

"The Wheeler-Lee Bill makes our unfair and deceptive acts in commerce unlawful. Bear in mind that the basic legislation of the Federal Trade Commission law merely made unfair methods of competition in commerce unlawful. In other words, if it could be shown that a given act in commerce was unfair under the old laws, it was not sufficient unless it could be shown at the same time that it unduly affected a competitor or the offended party. Now the commission has to show only that the act was unfair or deceptive, irrespective of the effect upon the competitor. A further provision in the Wheeler-Lee bill has to do with deceptive advertising. Keep in mind that under the old law, even though a given advertisement was unfair or deceptive, it had to have a bad effect on the competitor. Now the commission has only to show that an advertisement was unfair and deceptive to the *public*. . . ."

Mr. Ahearn then spoke of bills which are now under consideration. His remarks were prepared before the recent action of the House of Representatives in passing the wages-and-hours bill. On the subject of what the bill provides, he had this to say:

"It provides for a minimum wage of 25 c. an hr. with an annual 5 c. increase until the minimum of 40 c. an hr. is reached at the end of three years. The hours would be reduced to 42 hours the second year and to 40 hours the third year and continuing on that basis until changed by statute. The overtime rates of time-and-one-half are permitted. The use of child labor is prohibited. This law applies only to industries engaged in interstate commerce and the secretary of labor would be instructed to designate those industries engaged in interstate commerce. I have no doubt that the industrial-sand industry would be governed by this statute, if this bill should pass in its present form. At least, an effort would be made to bring this industry under its control. Of course, it would still be for the courts to determine whether that would be constitutional."

A vastly different bill having the same general objectives was passed by the Senate last year, and the two divergent pieces of legislation must now be harmonized. On this phase of the subject the speaker said:

"The only thing, in my opinion, which is going to block the wage-and-hour bill is a filibuster in the Senate, and a filibuster will be successful if used on the basis that the anti-lynching procedure was used. But if it does not succeed, then I believe that this present Congress will not adjourn until the federal wage-and-hour bill has been passed. This is the American Federation of Labor type of wage-and-hour legislation. They have objected to further delegations of administrative power in the bill in its present form and there is no administrative power in this bill. The department of justice will enforce this bill in the Labor Department. Anyone who ships in interstate commerce must comply, as a condition precedent to shipment, with this bill. If he fails to do so, he will be subject to criminal and civil action immediately. . . .

"The Wagner-Healy Bill about which some of you may not have heard, is a bill which, if passed, would create this situation: All the companies which contract with the federal government—and I don't mean to build post-offices, but anyone who sells anything to the federal government—must accept the findings of the National Labor Relations Board without question under penalty to cancellation of the contract, the purchase of those goods in the open market, and a demand that the offending company in the first instance reimburse the government for the difference between the contract price and the open-market price. Now the significant thing about that legislation is that it forecloses the ordinary right now enjoyed by individuals who are claimed by the board to have violated the Wagner Act to appeal to the circuit court. Furthermore, all who borrow from the federal government — states, counties, cities, and individuals — must certify that they, too, will accept the decision of the Labor Relations Board, not only as to themselves but as to their subcontractors. I don't believe that bill is going to pass. It is inconceivable to me that it should pass, particularly in the light of these new developments regarding the labor boards. The courts would extend their protection regardless of the wording of the statute, because certainly so far in this country we have not denied to any citizen the right to appeal to the courts even for a trivial thing.

Mr. Ahearn then brought out a fact which is not generally known, when he said: "Now it is a peculiar thing that most of the changes in business structure come from business itself. Something else which we should keep in mind is that there is hardly a law proposed at the present time having to do with the regulation of business that didn't come from some business organization; for instance, the Patman bill, now buried in the House Committee on Commerce, which would forbid direct selling. Everyone would have to sell through a dealer, no one could sell direct. That bill was sponsored by retail organizations. The National Assn. of Independent Tire Dealers proposed a bill and appeared up there *en masse* in support of it."

He reminded his hearers of the responsibility of industry to continue active in watching developments in Washington and in adjusting itself to the new conditions under which business must operate. He quoted from an address made by Ernest T. Weir before the Congress of American Industrial Leaders, who said, "To-day new things are expected of industry and of industrial leadership. Industry is expected to broaden its activities beyond the making and selling of goods. The industrial leader is expected to accept his responsibility not only to be an efficient producer and seller, but also to recognize the influence of his economic action in social and political fields, not only to guide the interests as the instrument for the making of all the material things that people need but in addition to use industry as an instrument that will aid in solving the human problems of poverty, unemployment, and other problems accentuated by the depression."

The closing session of the convention was devoted to a discussion of labor problems and many interesting facts regarding the relations between employers and employees were brought out.

The nominating committee presented its recommendations and the slate was unanimously approved. A. Warsaw, who has been the association's president since its inception, asked to be relieved of his duties, and in his place R. G. Hay of Zanesville was elected. L. M. Hansen of Chicago was elected vice-president, and R. T. Stevens of Cape May, New Jersey, was made treasurer. The board of directors will comprise E. J. Beyer of Rockwood, Mich.; Philip S. McDougall of Ottawa, Ill.; Mark T. McKee of Detroit, Mich.; A. J. Miller of New York; Junius M. Straus of Morgantown, W. Va.; and W. J. Woods of Lewistown, Pa.

By W. E. TRAUFFER

Skip-Bucket Transport System Serves South Carolina Limestone Quarry

View of quarry showing one of trucks and some of the skip buckets. At right are the primary and secondary crushers and at left is main conveyor to plant. The light area in center of quarry face is the new mine opening.

IN ALMOST any industry, it seems, there are a number of producers, both large and small, whose plants never quite reach the goal of perfection visualized by them. Such producers are constantly searching for and experimenting with new methods for doing things more efficiently, economically and safely. They are never happier than when a new method works out successfully. A marauding trade-paper editor can almost always depend on such a producer to have an interesting story waiting for him.

The officials of the Campbell Limestone Co., and particularly Robert S. Campbell, president and general manager, can safely be placed in this category. This company in 1935 completed an extensive improvement program at this plant, which was described in the March, 1936, issue of PIT AND QUARRY. Recently the writer again visited this plant and found that this story no longer gave a true picture of the company's operations as they had again been drastically altered from quarry to stockpiles. Our haste in publishing this description of these latest improvements is partly due to the fact that we have heard rumors about still further improvements and we want to get under the wire before this story becomes obsolete.

This is said to be the only limestone deposit in South Carolina being worked commercially and efforts are being made to create a demand for agricultural limestone as much of the soil in this section is lime poor. Much of the dust now created in the crushing operations is sold for fertilizer filler. The lime-

One of the two trucks which haul 1½-ton skip buckets.

stone is dolomitic and passes state specifications for surface treatment and concrete aggregate.

Stone had been loaded by hand into skip pans which were lifted by a crane and dumped into the primary crusher. In June, 1937, the operations had progressed too far from the crusher for this method to be used. This problem was solved by the purchase of two Dempster Dumpster units mounted on Ford truck chassis. Twelve 1½-ton Dempster skip buckets were served by these two Dumpsters. This method proved so satisfactory that in August, 1937, a third Dempster Dumpster unit, mounted on a Mack truck chassis, and 6 Type 200 H 2½-ton Dempster skip buckets were purchased.

A crew of 30 men load the skips and these with the three truck drivers feed 70 tons of stone per hr. to the primary crusher. Formerly a crew of 25 men loading and two men operating the crane produced only 40 tons per hr.

The gyratory reduction crusher which receives oversize from scalping screen at right.

Another truck and 1½-ton skip buckets being used for cleaning up the quarry preparatory to sinking another level.

The quarry is now being widened on the old 65-ft. level so that another 12-ft. level can be opened. Increasingly heavy overburden, however, has made open quarrying so expensive that it was decided to try mining the rock. The room-and-pillar method will be used with rooms 25 to 30 ft. high. The mine is being opened at quarry level by a wagon-mounted Cleveland drifter drill with 1¼-in. steel. This machine has a pneumatic advance and is mounted on two pneumatic-tired wheels and one steel wheel. Bench shooting with air drills is practiced in the quarry.

The overburden now ranges from 8 to 50 ft. in depth with an average of about 30 ft. The Thew Lorain 75 A gasoline drag-line, which formerly handled the skip pans in the quarry, is now equipped with a 1-cu. yd. Page dragline bucket and is used for stripping. This machine loads trucks which haul the material to a waste dump. Cleaning up of the rather rough and jagged surface of the deposit is done by men with hand shovels who load 1-cu. yd. skip pans. A Lorain Type O drag-line dumps these pans into trucks. An old Erie steam shovel is also used occasionally.

One of the 1½-ton skip buckets being loaded at the quarry face.

The 3 Dumpsters in the quarry back up a ramp and dump the stone from the buckets into a 24-in. by 36-in. Allis-Chalmers jaw crusher. A 24-in. belt-conveyor on 115-ft. centers feeds the stone from this crusher into the Allis-Chalmers No. 6 gyratory crusher, which formerly served as the primary machine. This method made it unnecessary to change the location of this crusher or the 350-ft. inclined conveyor which takes its product out of the quarry to the plant. The original 16-in. conveyor belt has, however, been replaced with an 18-in. Diamond belt to increase its capacity.

This conveyor discharges on a 4-ft. by 8-ft. Stephens-Adamson 2-deck vibrating screen which replaced the former 1-deck screen. Wire cloth with 1-

General view of the plant with conveyor from stock-piling tunnel to washing building at right.

in. and 3/16-in. openings is used. Material retained on the top deck goes to a No. 7 Allis-Chalmers Newhouse gyratory crusher which replaced the former crusher of the same type. The product of this crusher is returned on a 16-in. by 84-ft. belt-conveyor to the main conveyor from the quarry.

J. M. Pirkey, supt., and C. M. Simms, sales manager, of the Campbell Limestone Co.

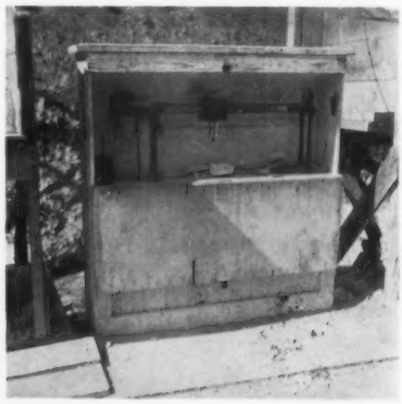
The other two products of this screen are discharged on the 20-in. by 84-ft. belt-conveyor running to the first sizing screening. A new Diamond belt replaced the original 16-in. belt on this conveyor. The stone is discharged on a 4-ft. by 12-ft. Allis-Chalmers Low Head 2-deck screen which replaced a smaller screen of another make. This screen has ¾-in. and ½-in. wire cloth on its top and bottom decks, respectively. Usually the two sizes of material retained on both decks are discharged together on a 60-ft. stock-piling conveyor. If desired, however, one size can be discharged by gravity into one pile and the other conveyed to another pile. A 1-cu. yd. drag-scraper is used to move these materials into stock-piles over the reclaiming tunnels.

The wagon-mounted drifter drill which is being used to open new mine.

The material passing through the bottom deck of this screen is discharged on a 14-in. by 132-ft. belt-conveyor running to a 4-ft. by 7-ft. Tyler Hum-mer 1-deck screen with 8-mesh wire cloth. Material passing through this screen can be loaded directly into trucks or it can be moved by a ½-cu. yd. drag-scraper to a stock-pile. This scraper can be reversed to feed from the stock-piles into trucks, if desired.

The material retained on this screen goes to a second 4-ft. by 8-ft. Hum-mer 1-deck screen which also has 8-mesh wire cloth. This screen is equipped with 25 Deister Concenco sprays. The washed material retained on it is moved to storage by another ½-cu. yd. drag-scraper. Provision is also made for loading this material into trucks. The water and dust passing through this last screen passes through a flume to a pond, where the fine material is settled out. The water overflows into another pond, which serves as a fresh-water supply. As often as necessary the settling pond will be drained and the accumulated fines removed.

The reclaiming belt-conveyor in the tunnel under the two rock stock-piles is 18-in. wide and 350 ft. long between centers. The tunnel is built of wood and has 30 gates feeding this conveyor. The stone is discharged from the tunnel conveyor on an 18-in. by 115-ft. inclined belt-conveyor running to the washing and loading bins. The rock can be discharged, by means of a flop gate, on either or both of two 1-deck washing screens. The 3½-ft. by 8-ft. Universal screen is equipped with 12-in. wire cloth, and under it is a 4-ft. by 5-ft. Tyler Hum-mer screen which gives the rock an additional cleaning before it is discharged into bins. The other washing screen is a 4-ft. by 7-ft. Tyler Hum-mer screen with 8-mesh wire cloth. All these screens are equipped with Deister Concenco spray nozzles. J. M. Pirkey, superintendent, is very well pleased with the improvement in washing efficiency obtained with these spray nozzles over the former method of slots or holes cut in pipe.



The 12½-ton truck scale on which all shipments from the plant are weighed.

The wooden truck-loading bins have a total capacity of 140 tons and trucks are loaded under them. Most deliveries are made by trucks but the company also makes railway shipments. The stone is hauled by the trucks a distance of one mile to a car-loading plant consisting of a conveyor and a bin. All shipments are weighed on a Webb City 12½-ton truck scale.

The two screens which wash all stone shipped after it is withdrawn from stock-piles. Note the spray nozzles and the even washing obtained.

LONG VERSUS SHORT ROTARY LIME KILNS

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By W. R. CLIFFE

IN 1937 three new rotary-kiln lime plants went into operation, and while the time which has elapsed is still not sufficiently long for definite appraisal, especially with the reduced or intermittent operation necessitated by current decreased business, it is only natural that the thinking men of the industry should find themselves divided into two camps on the subject of "long versus short rotary kilns". Naturally, the owners of the new properties are anxious to justify their judgment that the modern rotary kiln for the burning of lime should be at least 300 ft. long, which probably accounts, at least in part, for some of the glowing tales one hears, whereas the operator of the shorter kiln is just as naturally saying "You'll have to show me", and, in this, he is typically American.

It seems, on the surface of things, that the jump from 150- or 175-ft. kilns with two bearings to 300- and even 400-ft. kilns with five bearings is a long and daring one. Yes, the cement fellows did it, and got away with it, but that does not mean a thing. We do not question the mechanics of it. We question the practicability of it, as it applies to the many-sided problem of lime, and to succeed it must show very definite economies.

After years of experience with the shorter kilns, we had fairly well established a maintenance cost per ton of lime produced which will be the ultimate yardstick (not rubber) by which the success of the longer kilns will have to be measured. Likewise, we knew them to be wasteful of fuel, with a tendency toward excessive temperatures, over which there was little or no control, so that the twofold requirements of the long kiln were: (1) it should far surpass its shorter parent in fuel economy; (2) through longer exposure the hot end temperatures should be lowered, which would result in extending the life of the lining, and, at the same time, produce a milder-burned product. In the matter of mildness of burning no improvement whatever is noticeable, and, in the matter of temperatures in a majority of installations those at the feed and discharge ends are practically identical to those found in short-kiln practice, with insufficient fuel efficiency to warrant the added capital outlay and with the maintenance cost per ton of lime produced yet to be determined.

Mr. Cliffe will regularly contribute an article on modern lime production for this page. His broad knowledge of the industry has been gained in the last 14 years, during which time he has visited and studied American lime plants, serving successively as general superintendent for the American Lime & Stone Co., vice-president of the Chemical Lime Co., and in his present capacity as chief engineer for H. E. Millard at Annville, Pa. He is 42 years old, attended Temple University, Drexel Institute and the University of Pennsylvania. After serving in the French army during the world war he entered the contracting business in Philadelphia and later was engaged in the construction of sand-and-gravel plants for the Warner Co.

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This condition is a result of the use of a type of kilns unsuited to local conditions, to improper design, and to a lack of thoroughly-experienced advice. It should not be taken from this blunt statement of fact that the manufacturer of the kiln equipment is to blame for this apparent failure, because quite the contrary is true. The design and workmanship involved are so much advanced as to make the earlier attempts seem very crude, and after all most purchasers of rotary kilns strive to obtain the most for their money on a poundage basis. As the unit is generally constructed to his specifications, the result is that he buys a kiln and not an engineering service. Surely, we can not expect the kiln fabricator to know the intimate details of the individual lime enterprise. Furthermore, the day is past when the operator can order a steel shell so many feet long and so many feet wide, and expect to line it with bricks and have a unit which will produce quality lime economically. So failure, if it is failure, must rest upon those specifying the type of kiln, the auxiliary equipment, the control systems, and the general scheme.

In those instances where anticipated results have been realized only in part, it is probable that experience and intense study will point the way to the very real savings possible and to ultimate success. Some of the necessary changes will be costly, and the results obtained through alteration are never as satisfactory as in cases where the requirements have been met in the original design well in advance of actual construction. The amount of money which has been needlessly spent in some cases should serve as a constant reminder—"be sure you are right, then go ahead"—to any producer entertaining dreams of improved quality at lower production cost via the long kiln.

Operators of vertical kilns seem to be approaching quality and economy consciousness in a more practical manner. Great progress is being made by improving existing equipment and in the refinement of control methods. In this way change is not so rapid and radical, but certainly surer and far less expensive. No doubt this approach has its ups and downs, but the trend is noticeably up. As one goes about, he is everywhere impressed with improvement activity. The economies and output claimed for some kilns, where the technique has been improved, are actual facts and, though many of us claim the lime market is indicating an increased desire for rotary-kiln products, there is, and always will be, a fertile field for lime produced in the vertical kiln. Many of the vertical kilns now being rebuilt were originally constructed shortly after the war between the states. During this period practically no change in practice worth mentioning has been apparent. It is to be hoped that in the case of rotary kilns, which pioneered that practice in the early 1920's, their full possibilities will be thoroughly explored in a much shorter period, and it is well within reason to expect some very interesting developments and results.

The encouraging feature of this great adventure of the long rotaries lies in the awakening of lime producers generally to the inadequacy of methods and equipment, which have remained comparatively unchanged during a long period, while other chemical industries were making their greatest strides. Out of it all will come a real economy and quality that will acquit the industry of the charge of backwardness.

[Note: In this brief article we have attempted only to generalize. In future articles we shall discuss many phases of modern lime production.]

PIT AND QUARRY Special Section

PROFITABLE NEW PRODUCTS

THE NEW LIME-PUTTY PLANT OF JAHNCKE SERVICE, INC., NEW ORLEANS, LOUISIANA.

Two-tank lime-putty installation of Concrete Construction & Supply Co., Columbia, S. C.

South Carolina Ready-Mix Firm Operates New Lime-Putty Plant

ONE of the latest additions to the ranks of lime-putty producers using the Brooks-Taylor method is the Concrete Construction & Supply Co. of Columbia, S. C. This company has dealt in building materials for many years and in 1931 built a ready-mixed-concrete plant. Brooks-Taylor franchise was obtained by the company in 1935, and the tanks and other equipment for the plant were purchased at that time. This franchise was not taken up until 1937, when the construction of a lime-putty plant was begun. This plant went into operation in June, 1937.

The local sand and stone used as aggregates in the concrete are received in trucks and cars, respectively. A. P. & H. crawler crane with a ¾-cu. yd. clam-shell bucket loads these materials into the four-compartment, 140-ton Erie steel aggregate bin. Two sizes of stone and two grades of sand are stored to meet the various specifications. An Erie 20,000-lb., 1-compartment Aggremeter with a Howe 3-beam scale is used to batch the sand, stone and cement. Cement is dumped from wheelbarrows fitted with Goodyear pneumatic tires to a Link-Belt vertical screw-elevator which feeds the Aggremeter. Water is measured by a Worthington liquid flow-meter. Concrete is mixed in a 1-cu. yd. Smith mixer from which trucks are loaded direct.

When the ready-mixed-concrete plant first went into operation all the mixing was done in the plant and deliveries were made by trucks with bath-tub bodies. Some of these are being used by the company on its contracting work and can still be used for concrete delivery in an emergency. In 1935 the company purchased three 1½-cu. yd. Jaeger truck-mixers.

The central-mixed concrete plant and one of the trucks which make deliveries.

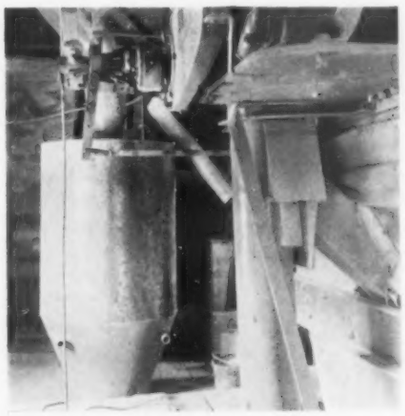
Three more 1½-cu yd. truck-mixers of the same make have since been added, the last one in December, 1936. These are used as 2-cu. yd. agitators. They are mounted on Mack and International truck chassis and all have power take-off drives.

The truck-mixers have given remarkable service. Records kept for the two years since the first truck-mixers were purchased show that a total of $9.00 was spent on the maintenance of all six mixers during that period. In the mixers which had operated the full two years it was found that there was only .010 in. wear on the mixer blades. In that period each truck had delivered over 3,000 cu. yd. of concrete. None of the mixer blades were rebuilt during that time. This record is the more remarkable because of the abrasiveness of the crushed granite used.

Now that the lime-putty plant is in operation it is planned to remove the plant mixer and do all the mixing in the trucks. This will facilitate the loading of sand into the truck-mixers for sanded lime mortar. The ingredients for concrete will also be loaded into the trucks direct from the batching equipment. The trucks will be loaded through a chute lined with Goodrich rubber chute lining. For making concrete enough water

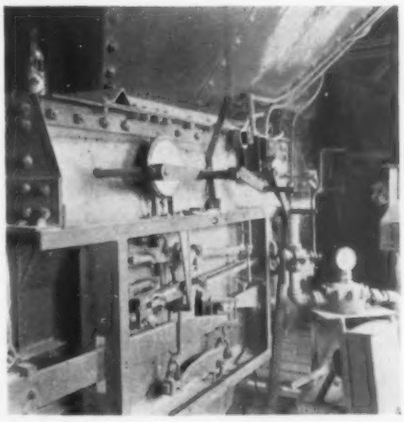
will be measured into the truck-mixer for about a 4-in. slump and more water can be added from the truck-mixer tank when a higher slump is desired.

High-calcium lime from the Calera, Ala., district is being used in the lime-putty plant. This is received in bulk in box-cars, from which it is unloaded into a 5-ton bin. As the slaking of this lime is very easy to con-



Cement screw-elevator to the batcher. Water is measured into the tank by meter.

trol, no batcher is used to feed the lime from the bin into the slaker. The 1-ton revolving-blade-type slaker has a Taylor recording thermometer which makes possible accurate control of the slaking process. A 3-in. Allis-Chalmers centrifugal pump transfers the slaked lime into the two 2,500-cu. ft. seasoning tanks. These are vertical gasoline storage tanks 10 ft. in diameter and 33 ft. high. Into these tanks have been built conical bottoms and square center filters, which have 16-mesh galvanized screen cloth and are filled with washed sand. These screens can be rotated for cleaning, and access to the interior of each tank is obtainable through 24-in. manholes at the top and bottom. There is a steel ladder inside each tank.



Weighing batcher and scales. The water meter is at the right.

Truck being loaded at the concrete mixer. The crane loads aggregates into the bins.

The putty is withdrawn from each tank through a 4-in. gate valve mounted on a 16-in. flange, which can be dropped when the tank is being cleaned out. A calibrated volume-measuring hopper is used to measure the lime putty into the truck-mixers. This hopper is mounted on rails so that it can be used under either tank. Sand is batched into the trucks at the concrete plant when sanded lime mortar is ordered.

The company also does concrete contracting and about one-third of the concrete produced is used in this work. The plant has a capacity of about 250 cu. yd. daily. In 1936 over 24,000 cu. yd. of concrete was sold. Most of the product is used in private construction but sales are also made to the city, state, county and Federal governments. The lime-putty plant can produce about 1,000 cu. yd. of lime mortar per month.

New Specifications Omit Reference to Grain Size

For several years there has been a marked trend toward finer and finer grinding of finished cement. Accompanying this movement was the development of a new technique in testing fineness, namely the use of the turbidimeter to measure it on the basis of specific surface, that is, the surface area of the particles expressed as square centimeters per gram. It is now generally recognized that screen residues furnish inadequate information on the fineness of impalpable powders and that the specific surface method gives more complete information as to the actual service and behavior that may be expected. Therefore, in recent specifications the fineness demanded is expressed as specific surface rather than screen size.

The rapidity and ease with which tests may be made with a turbidimeter resulted in a tendency toward writing specifications setting a rather narrow range of fineness between fixed upper and lower limits. Fearing that rigid limitations might impose an unnecessary hardship on cement producers, Committee C-1 on Cement, of the A. S. T. M. wrote a new specification for Portland cement omitting all reference to grain size. The committee justifies its action first on the claim that all cements are now ground much finer than was required in the old specifications, and, second, because the strength, volume change, and other properties are influenced by fineness; therefore, with adequate limits for these properties, the requisite fineness will be obtained automatically, Oliver Bowles of the Bureau of Mines points out.

At a meeting of Committee C-1 on Nov. 5, 1937, a recommendation was made that the fineness requirement be deleted also from the Standard Specification for high-early-strength Portland cement (C74-36).

Gypsum Output Reached New High Last Year

Although suffering serious reverses caused by the decline in construction in the latter part of the year, the gypsum industry in 1937 reached a new high total sales value of all gypsum products (uncalcined and calcined) since 1930. In two of the general groupings of gypsum products, uncalcined and for building uses, the sales were greater than the like 1936 figures, Bureau of Mines reports show. The third group, for manufacturing uses, showed a decrease in tonnage but an increase in value over 1936.

Revisions in the 1937 canvass were a modern product classification, inclusion of companies utilizing byproduct gypsum and several other processing companies and the reporting of total tonnages and values of all gypsum products manufactured in the United States irrespective of the source of the crude gypsum whether domestic, byproduct or imported.

Apparent supply of crude gypsum (not including crude byproduct gypsum) in 1937 was 3,955,650 tons or 16 per cent. higher than 1936. Domestic crude production of 3,058,166 tons was the highest since 1930. Crude gypsum was mined in 17 states with New York, Michigan, Iowa and Texas leading. Crude gypsum imported in 1937 was 897,484 tons.

Calcined gypsum produced or kettle and kiln output (including calcined byproduct gypsum) was 2,411,362 tons with a plant value of $11,076,205 estimated by the producers.

PROFITABLE NEW PRODUCTS

Developing New Markets for Ready-Mixed Concrete*

By W. D. M. ALLAN
Director of Promotion,
Portland Cement Assn.

THERE is always a tendency, and properly so, for every sales organization to strike hardest for the business that is immediately available. Yet this kind of selling alone will not generally create a growing and stable market. It is necessary also to do creative selling. By creative selling I mean the development of new uses and users—broadening the market base.

It is easily possible for a ready-mixed-concrete concern with a very large volume of business to find itself with little or no warning almost completely without markets. Two or three large jobs in a community may cause a plant to work at capacity, but when these are completed, it may be that there are no more large jobs of the same class of work available and the plant is without orders. The more outlets you or we can develop for concrete, the more stable our business and the less we suffer in times of slump.

We might compare the ready-mixed-concrete market with a pyramid; the broader the base, the more stable the structure. Little proof of this statement is necessary. We know what happened to the exclusively wheat farmers when the bottom dropped out of the wheat market. Likewise, with the cotton farmers. We also know that the diversified farmers were much more secure than "single croppers".

Closer home we have a similar experience in the concrete-products field. During 1936, due to the P. C. A. national housing advertising, more than 60,000 inquiries were received. These were separated and forwarded to concrete-products men as leads for prospects. To find out what products men were doing with the leads, our field men checked up in various communities. In some cities the products men were paying no attention to housing leads because there was, for example, a 50,000-block order available in some P.W.A. school addition, armory or other public building. Certainly an order for 4,000 blocks in a residence is not as important as an order for 50,000 blocks in a public building if we consider them as individual orders; but when we consider them as markets we recognize that in the housing field a new and continuing market is being developed and that hundreds of 4,000-block orders are potential, whereas in the public-building field as soon as P.W.A. resources were withdrawn the number of jobs was greatly reduced and the market was unimportant.

The temptation is always to neglect market building, which requires considerable time before a definite order is obtained, even though there may be a large number of continuing orders as a result. Of course, we should go after every bit of immediate business that is available, but no company or industry in the construction business, where products and methods are changing so rapidly, is in a safe position that does not devote a certain amount of its energy to developing new markets.

For the purpose of this discussion it is assumed that recently-published data on trends in building construction for 1938 are familiar to you. But let me introduce two cautions when studying statistical trends covering the entire country:

(1) Don't be misguided by the optimists who seem to believe that wishing for something will make it come true. Those who have been predicting from 500,000 to 1,000,000 housing units a year are in this class. Since the beginning of the housing upturn the F. W. Dodge corp. estimates have been most reliable.

(2) General averages and curves for the entire country or large regions are significant only as indicators. We must not draw definite conclusions for a limited market from general trends. National trends are valuable principally to companies selling products over large areas. Each of us is working in a relatively-small area which may run counter to or far ahead of average trends. Your particular territory may parallel the general trend, yet the type of business may or may not be such that a large volume of ready-mixed concrete is available. All of which adds up to the need for balancing local conditions against general trends.

There seems to be fair agreement that the total volume of construction business for the first half of 1938 will be below the corresponding period for 1937, also that there is likely to be a resumption in the latter half of 1938 sufficient to bring the total for the year above 90 per cent. of the 1937 total. Conservative estimates of prospective construction indicate that one- and two-family houses will show some increase—not more than 10 per cent. above 1937. Again, these are nationwide averages and what may happen in St. Louis, Detroit, Minneapolis or New York may far outrun the national trend or run counter to it.

Whether the volume of housing develops rapidly in 1938 or is delayed one or more years in any particular market, the fact remains that the "back-log" of unfilled small-house business is by far the largest in the building field and must sooner or later account for a tremendous volume.

Along with new-house construction will come an increasing volume of remodeling and repairs, not spectacular business in 1,000-cu. yd. orders, but in total a worth-while volume for those organizations equipped to "cash in" on it. In some communities it may be a case of getting this small-unit business or getting no business at all.

Methods for obtaining business in the small-construction market must of necessity be different from those found most efficient in the large-unit market. Obvious as this appears, it is rarely practiced in the building indus-

*Presented at the 1938 Convention National Ready Mixed Concrete Assn., Cincinnati, O.

try. An organization that has a fine record for the development of large-unit business through personal contact usually assumes that personal selling is the most economical way to obtain business in the entirely different small-unit market. This error comes from thinking in terms of our own organization rather than in terms of the market to be developed and the kind of sales effort best suited to sell it.

It is not uncommon to shift bodily a large-unit sales organization to a small-unit market and expect the salesmen to turn in volume comparable to their previous records. The inefficiency of such selling is comparable to that of a sewer contractor equipped to build an 84-in. sewer in a 30-ft. cut shifting his equipment to a 12-in. sewer in a 6-ft. cut. There is just as much difference in the sales equipment needed to handle large- and small-unit markets as there is in the construction equipment on large and small sewer jobs.

Let's assume that our greatest opportunities for developing new business are in the small-unit field: housing, remodeling, factory repairs, foundations, driveways, etc.—from 2- to 50-cu. yd. orders. The first problem that appears is that there are a great many transactions or sales to be made if the volume is to be worth-while. Second, the prospective buyers are scattered all over town or out in the country. They are unknown to the salesmen. The use of salesmen to hunt out hundreds and hundreds of unknown prospects who might use concrete and to sell them the advantages of ready-mixed concrete is out of the question. You can't hire enough legs and tongues to do such a job. Mass-selling methods must be employed to dig out the prospects and to at least do part of the job of selling the advantages of ready-mixed concrete.

The more common forms of mass-selling tools are:

(1) Personal letters.

(2) Printed matter — booklets, literature, etc.

(3) Space advertising in news and local builder papers.

(4) Newspaper and other forms of publicity.

(5) Exhibits.

(6) Use of classified 'phone directory.

(7) Brilliantly painted trucks with easily identified name and 'phone number.

(8) Billboards.

The above items are not listed in the order of their importance; this varies with each company and market.

Each letter, booklet, "ad" or publicity story should convey four essential ideas:

(1) The improvement promoted should be extensively needed in the market;

(2) Advantages of concrete and the convenience and extra advantages of ready-mixed concrete;

(3) Definite suggestions for prompt action;

(4) A clear statement as to where the ready-mixed concrete can be obtained—name, address and telephone number prominently displayed.

During the past year we have received many requests from ready-mixed-concrete men asking us for suggestions for developing business in their markets. The foregoing list has been offered in each case.

We shall be glad to coöperate with the National Ready Mixed Concrete Assn. in:

(1) The preparation of a series of eight or ten letters which could be used as the basis for local selling. These, of course, would have to be adapted to local conditions, but the suggestions contained in them might be of considerable help in preparing sales letters.

(2) The preparation of any booklets or circulars which you may wish to use locally. We can prepare suggested copy and lay-out and indicate the cuts that would be needed. You in turn could have them printed locally. All you would have to do would be to write our district office suggesting high points which you wish to stress and we would work it up in booklet form. . . .

In larger markets, where there are several reputable ready-mixed-concrete plants and where the job is largely educational, I suggest that you consider coöperative advertising; that is, an "ad" signed by two or more ready-mixed companies. This will split the cost and will do nearly as good a job for each as the same amount of advertising signed by a single company.

A differentiation should be made between advertising that is of an educational nature, aimed at getting people started to think in terms of certain improvements or the use of ready-mixed concrete, and the advertising necessary to do a hard-hitting sales job; that is, to sell your particular company's product after the market has been reasonably well developed. During the first stages—the educational period—the coöperative advertising is satisfactory. In the latter, or hard-hitting selling, stage I would recommend individual advertising.

Engineers and those of us in the construction industry have rarely been notable as great merchandisers, particularly not as great advertisers. We all know that Wrigley's chewing-gum success is based on advertising merchandising. We know that the great automobile industry relies to a large extent on elaborate advertising to develop business and sustain demand. I believe that we have a good opinion of the force of advertising in developing business, but some of the details of it, some of the discouragements, are not familiar to us. They should be recognized before any advertising is undertaken.

Running one or two or three "ads" in the daily newspaper telling about concrete improvements and the advantages of ready-mixed concrete is not likely to develop much, if any, business. If there is any one thing fundamental to successful advertising, it is continuity. An advertising program to produce results must be properly conceived, carefully written, but it must be continued. We have known of some ready-mixed-concrete men and concrete-products manufacturers who have become inspired over the possibility of advertising, made a small appropriation, placed three or four "ads" and given it up as a bad job. Don't undertake advertising if you can not see your way through a reasonably long-time program, because you are trying to develop new ideas and establish a product in the public mind.

Another discouragement in advertising that should be recognized before it is started is with regard to the prospects or calls that you get from your "ads". First of all, you may not get any. Several years ago we ran concrete-pavement advertising in the *Saturday Evening Post*, reaching over 3,000,000 people, and we received only 6 inquiries in one week. Other advertisers with smaller space received thousands of inquiries. We must recognize that in some commodities people do not answer "ads".

Again, you may get a considerable number of inquiries, but if you send your salesmen out to interview the leads you may find that children who have no intention of buying or some indigent person living in a cheap rooming house sent them in. It may be someone who is collecting information because he thinks that some day he is going to build. Be prepared in advance to receive a considerable number of inquiries of this kind, because they are quite a jolt if you are not braced for them.

You can be confident, however, that if the advertising is continued you

will gradually establish your product and your name in your community and the telephone will ring many times and the mailman will bring many letters asking for estimates on this or that use of your particular ready-mixed concrete. There are many ways of sifting through the inquiries to determine which are most important.

In general, inquiries may be divided into three kinds:

(1) "Hot" leads requiring immediate personal contact;

(2) Possibilities, requiring the mailing of a booklet, a telephone call from a salesman when he is in the territory;

(3) Useless; forget them.

The value of an advertising expenditure is largely determined by the skill of the sales force in classifying leads and concentration on the "hot" ones. A salesman who desires to prove that the advertising is no good can do so easily by making personal calls on inquiries without first classifying them.

I would like now to make a few suggestions of sources of additional ready-mixed-concrete business. I do not refer to specific jobs, but principally to classes of jobs. Some of this work requires a considerable amount of effort before any business is created. But once the new use is established, it may result in a large and continuing volume at small sales expense.

(1) It may be the practice in your market to build residence foundations of brick or stone masonry. Let me suggest that you study the problem of getting the building code changed to permit, say, an 8-in. concrete wall instead of a 12- or 16-in. stone wall or a 12-in. brick wall. It usually is not wise to go first to the building commissioner and raise this problem. It should be carefully studied to find the avenues along which the job can be done with the least amount of effort; then, when a careful program is prepared, start it to work.

(2) The sidewalks in many of our older cities are badly out of grade and in many cases in a bad state of repair. Some cities have passed ordinances requiring that all sidewalks which are away from grade must be replaced. You may be able in your community to start a newspaper campaign or get some of the service clubs or even the building department to get interested in the passage of an ordinance requiring property owners to put their sidewalks in repair within a certain length of time. If the property owner neglects, the city will make the repairs and charge it on the tax bill.

(3) Another idea that has been worked is to require that driveways crossing sidewalks be made 6 or 7 in. thick. This is to prevent coal trucks from breaking the sidewalks.

(4) It will pay ready-mixed-concrete men to become familiar with the fire zones in their particular city. If these zones can be extended considerably, it means that fireproof construction must be used and there is always much more opportunity for ready-mixed concrete in fireproof construction than in ordinary construction.

(5) An important competitor of the quality ready-mixed-concrete producer is the "gyp" concrete contractor. One-five-nine foundation mixes are not uncommon. With the strength of the cement improved greatly during the last few years, we have heard of 1-8-14 mixes. How this stuff stands up is a mystery, but that is what folks are getting in some communities for concrete. In connection with the building code you might be instrumental in establishing some kind of inspection service which will require definite quality of construction materials for various uses.

This must in turn work to the benefit of those producers who make quality concrete; it will benefit the purchaser because he will get the kind of concrete that he should have; it will work against the "gyp" contractor because he can not produce quality concrete at poor concrete prices.

(6) The question of public-parking areas is becoming very acute. You might promote the idea of public-parking areas in vacant lots throughout the city to get the cars off the streets.

(7) Another plan that has been suggested and which may result in a considerable volume of ready-mixed concrete work is inside curb parking. In many residential sections there is sufficient space between the curb and the sidewalk to park cars so that the car is inside the curb line. If you can get this practice adopted in your market, it should result in a substantial volume of new concrete business.

(8) The development of the reinforced-concrete house, which we believe has real possibilities, should open a considerable market to ready-mixed men. It will pay you to become familiar with this type of construction and discuss it with realtors and contractors.

Many years ago there was developed a method of construction whereby residence walls were cast in a horizontal position and lifted into place. Several hundred such houses were built, but with the depression the method fell into the discard. Our Development Department has been working for several months to improve it and has successfully erected such a building. We believe that it has great possibilities because it almost entirely eliminates form work and makes possible the use of large production tools in placing, finishing and erecting. If this method of construction becomes popular, it should mean a considerable volume of business to ready-mixed-concrete producers because of the high and uniform quality of concrete which will be required. The method can be applied to residences, small commercial and farm buildings.

(9) Nothing that we have undertaken to promote in the last ten years has taken hold more rapidly than concrete first floors in residences. More than 20,000 such floors were built in 1937. Please remember that this idea got its start only three or four years ago, at the bottom of the depression. Hundreds of frame houses have been built with concrete first floors. Basement walls, floor and concrete first floors have been tied together as one rigid unit. If you are furnishing the ready-mixed concrete for the foundation walls and are able to get the owner to use a concrete first floor, it will mean 8 to 10 additional cubic yards of concrete for you. If this style becomes established and all houses have concrete first floors, a continuing market of upwards of 3,000,000 cu. yd. of concrete will be developed.

In conclusion, let me emphasize this one point: The cement industry and the ready-mixed-concrete industry must devote a considerable amount of their time to creative selling; that is, developing new and more extensive uses of our products. We must broaden our market base.

New ready-mixed-concrete plant of the Billiter Co., Newport, Ky., which went into operation in March.

JAEGERS GIVE YOU *a recognized advantage*

. . . . a Higher Strength, More Workable Concrete, Preferred by Engineers and Contractors . . .

Plus the Most Efficient, Low Cost Mechanism Yet Developed for Transit Mixing and Delivery . .

More concrete is sold by Jaeger Truck Mixers than by any other method—approximately $30,000,000 worth last year —and the demand KEEPS ON GROWING.

Here is one business that offers opportunity—to make a better profit than you could ever earn by selling bulk materials, to expand your present sales of "ready-mixed," or to establish a new business with the advantage of known quality in your product and greater efficiency in your operating equipment.

Write today for our new Specification TM-37, giving data of essential importance to present and prospective operators of ready-mix plants.

THE JAEGER MACHINE COMPANY
602 Dublin Avenue Columbus, Ohio

JAEGER

Keeping of Wire-Rope Service Record Urged

Time was when wire rope was universally considered a "minor" item of equipment. There were two reasons: (1) the cost of a few hundred feet of wire rope was so small in comparison with the investment necessary in a power shovel, drag-line or hoist that just out of sheer relativity the rope seemed of minor importance; (2) all wire rope was pretty much the same. It was a staple (and good) product regardless of who made it, with the result that, depending upon the engineering skill with which the wire-rope salesman, or buyer, specified the size, grade and construction of rope to be used for a given application, all ropes were fairly uniform in the service they gave.

Within the past dozen years or so, however, manufacturers have learned how to preform wire rope. And the preforming process so completely relieves wire rope of internal torsional stress, leaving the completed rope relaxed, limber, and with far more balanced strand tension, that for many quarry applications preformed wire rope is far superior to non-preformed. Indeed preformed wire rope invariably gives so much longer service that operators have had the matter of comparative wire-rope service forced upon their attention. After using one or two preformed ropes, then switching back to non-preformed, the wide variance in service made the operators acutely conscious of the frequency of machine shut-downs brought about by the ordinary wire rope's aptitude for early failure. And machinery shut-downs can be extremely costly. The superintendent painstakingly tries to keep all his operations simultaneously at work. But it is this carefuly arranged schedule that is completely deranged when a wire line breaks and a machine is down.

WIRE ROPE SERVICE RECORD

Equipment Operated by .....
In What Service: .....
Equipment Description of .....
Condition of Sheaves .....
Rope Diameter ..... Construction .....
.....
Grade ..... Lay .....
Record of ..... Rope
Date On ..... Date Off .....
Work Accomplished .....
.....
Lubricated (Dates) .....
Remarks .....
.....
Record of ..... Rope
Date On ..... Date Off .....
Work Accomplished .....
.....
Lubricated (Dates) .....
Remarks .....
.....

Preforming, now universally applied by all wire-rope manufacturers, has shown many superintendents that wire rope is an extremely important piece of equipment. He now knows that on it there frequently depends the production of both costly machines and costly man power. Many operators are now using various systems for keeping a record of their wire-rope service. One operator has developed a very simple, yet very effective, record form printed on a 5-in. by 7-in. card. The accompanying reproduction of this service record card shows it capable of keeping track of the service of two ropes. When filled, these cards are turned into headquarters, where the information is transferred to a permanent "Service Report Ledger."

PROVEN EARNING POWER

When DUNBRIK Manufacturers show sales of three million brick per year with production costs as low as $5.00 per thousand—others with selling price of 100% over cost—proves the great earning power of this line-production brick machine.

These enviable records are the result of producing a superior product,—lighter weight, greater strength, lower absorption, absolute accuracy, and with true corners. In addition, multiple sizes of standard brick (DUNSTONE) can be produced that permit hollow, insulated wall construction at cost level of frame.

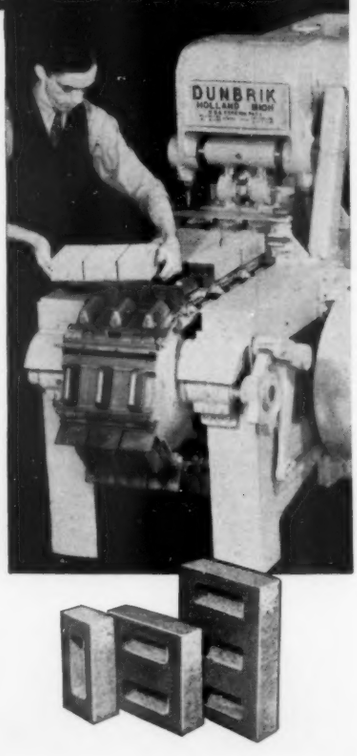
Write today for new book "4 Keys to Success" and learn about this wonderful machine, permitting large production with only one or two men and costing but a fraction of what would be required for other processes of equal capacity.

DUNTEX ROOF TILE MACHINE

With this machine you can dominate the vast roofing material market with a product unequalled in value, permanence, beauty and fire-safety. Your manufacturing costs are low, investment moderate, and selling prices offer attractive profit.

Send today for "DUNTEX Survey"

W. E. DUNN MFG. CO.
420 W. 24th St. Holland, Michigan



The Popular Choice ★ BLAW-KNOX TRUKMIXERS and Agitators

★ Preferred by contractors, engineers, and users *because:*

. . . they mix concrete faster and more thoroughly.

. . . they produce high strength concrete of maximum workability.

. . . the exclusive Blaw-Knox Water Measuring System is accurate and dependable.

. . . Blaw-Knox Trukmixers are free from breakdowns and delays, insuring continuous dependable service.

. . . they have greater durability due to the use of high quality materials and superiority of design.

. . . ease and speed of operation mean more trips and greater profits.

The desirable and popular features of Blaw-Knox Trukmixers and Agitators are completely illustrated and described in the new Blaw-Knox Catalog No. 1582. *Send for your copy.*

The Reason— Users Compare the Details and Then Buy

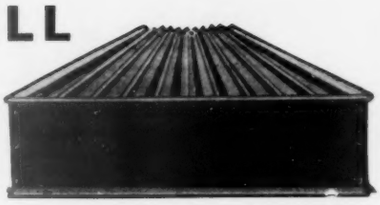
BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
Farmers Bank Building • Pittsburgh, Pa.
Offices and Representatives in Principal Cities

What Helps Business Helps You!

BLAW-KNOX

EASY TO MAKE EASY TO SELL

Concrete Joists



R & L "Crescent" Ten-Gang Joist Mold

For you aggregate men who are looking for a profitable side line with a ready market . . . there is a big opportunity at small investment in the R & L Concrete Joist Machine. The building industry is "sold on" concrete joists . . . it's just a matter of taking orders for a proved product.

R & L *Write for Bulletin and full details*

CONCRETE MACHINERY CO.
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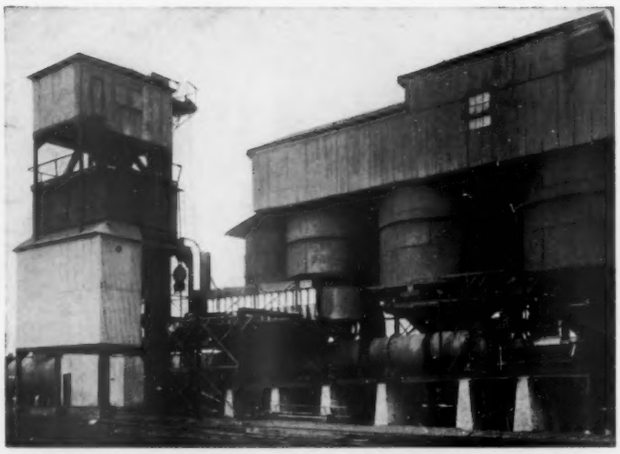
We also manufacture Pipe Molds and Machines, Tile Forms and Vibrating Tables



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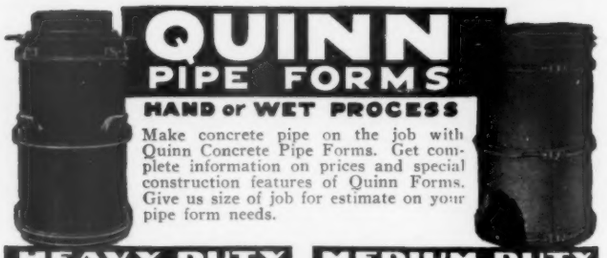

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Pre-stabilized materials can be delivered, applied and compacted with the least interference with residents and traffic. Residents want dustless streets. City officials want to supply them. Producers of plant-mix aggregates are the natural source of supply.

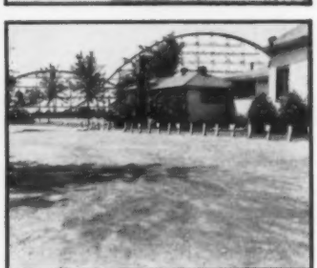
Private estate driveways are also a natural for plant-mix materials. Architects prefer artistic gravel or stone drives. Pavements are both costly and inartistic. Stabilized drives are adequate for traffic, dustless, artistic and fit the landscape.

Pavement shoulders are most satisfactorily taken care of by use of stabilized soil mixtures which hold up to the edge of the pavement, compact firmly under traffic, provide safe emergency turn-outs and tire change foundations.

Parking lots in cities offer wide sales opportunity to provide plant-mix materials to produce dustless, compact parking surfaces at lowest cost.

Cemetery and park drives should always be firm and dustless. Stabilized soils provide the best type of low-cost driveway for the traffic volume encountered.

Tennis courts and playgrounds can be built of stabilized sand clay mix to provide firm, dustless play surfaces with less sun glare.



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MEN · OF · THE · INDUSTRY

James Ernest Montgomery was born in Orangeville, Ontario, about fifty miles north of Toronto, on Jan. 31, 1887. He moved to Toronto at the turn of the century and has since resided there. Starting in the teaming business he hauled pit-run gravel and, in 1920, began using motor trucks. In 1926 he built his first screening plant, other plants of greater capacity being erected successively. His newest operation, described in the November, 1937, issue of Pit and Quarry, was designed by him and his brother, H. A. Montgomery, who is general manager.

Personal Mention

THOR GERMUNDSSON, structural engineer attached to the Portland Cement Assn. headquarters office at Chicago, left April 21 for a two-months' visit with his parents at Copenhagen, Denmark.

J. C. H. Dussault has been elected director of Asbestos Corp., Ltd., Montreal, Que., succeeding R. O. Sweezey, who resigned.

W. A. DAVIS has been elected president of the Standard Portland Cement Co., Painesville, O. He was formerly vice-president in charge of sales.

M. D. CARREL has been appointed manager of sales in the central territory by the Union Wire Rope Corp. of Kansas City and Tulsa. Mr. Carrell's headquarters will be at 431 Pershing Rd., Chicago, Ill.

BERT HILLERT of New Braunfels, Tex., has started production of sand and gravel at a location on the Blanco River, east of San Marcos, Tex.

TOM GESLIN is in charge of the new Westenhaver gravel plant recently opened near Logan, O., by the Logan Sand & Gravel Co.

FREDERICK C. HILLER, assistant auditor of the Monarch Cement Co., Humboldt, Kan., was married recently, the bride being Miss Beulah Hackler of DeSoto, Kan. Mr. and Mrs. Hiller have returned to their new residence in Humboldt following a southern wedding tour.

WILLIAM S. BRANTINGHAM and BURL CALDWELL have opened a plant for pulverizing limestone for agricultural use at Johnson, Ark. Raw material is being obtained from the Ozark White Lime Co.

DON D. PRICE, formerly district engineer for the Portland Cement Assn. at Lincoln, Neb., is now technical engineer to the Ash Grove Lime & Portland Cement Co. He will be located at Omaha.

T. J. PALM has leased the county gravel pit near Fayetteville, Tex., and will operate it on a royalty basis.

J. O. MCMICHAEL heads the newly-formed McMichael Concrete Co. at Lubbock, Tex., which will shortly begin the production and sale of ready-mixed concrete.

W. H. DAY has been appointed general sales manager of the Peerless Pump Division of Food Machinery Corp.

WILSON D. ROTH, 61, superintendent of the Nazareth, Pa., plant of the Pennsylvania-Dixie Cement Corp. for the past quarter century died in an Easton hospital recently. The widow and four children survive.

J. C. CAMPBELL, 78, president of the Newark Wire Cloth Co., Newark, N. J., died recently. He had been connected with the wire-cloth industry for more than 60 years.

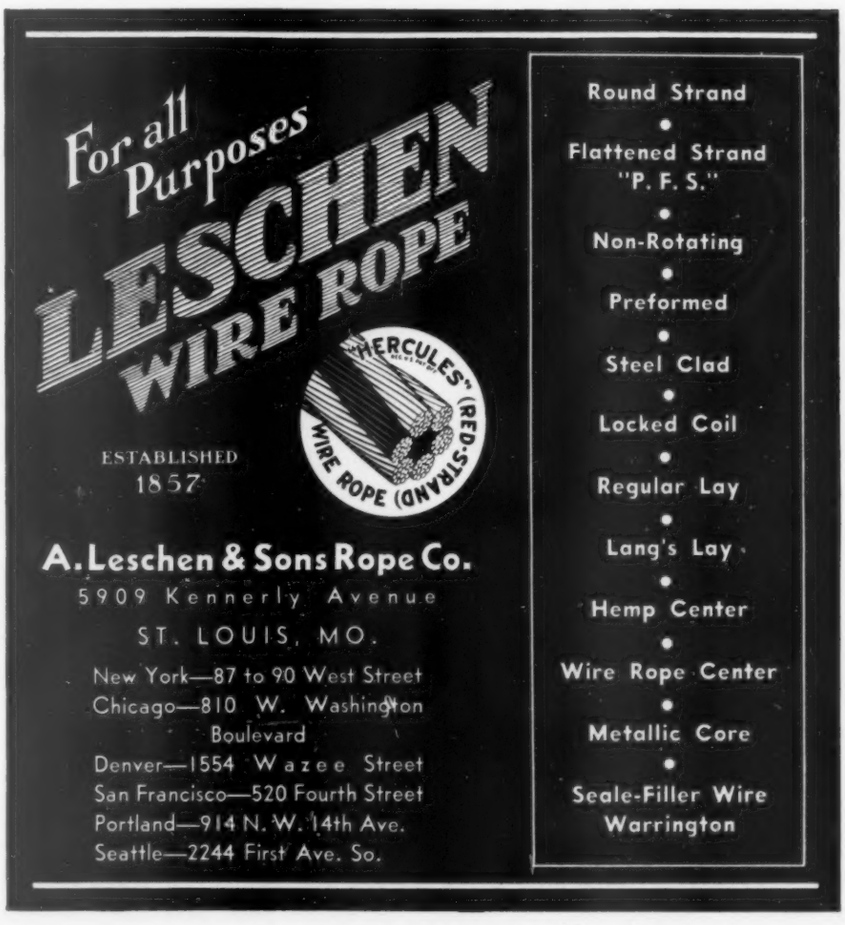
VIRGIL DAVIS, 34, driller employed in the quarry of the Red River Stone Co., near Heber Springs, Ark., met his death recently when he was struck by a falling bowlder.

EDWARD R. HART, 54, president of the asbestos-products firm bearing his name died a short time ago at his home in Canton, O. He was connected with the Johns-Manville Co. until 1921 when he organized his own company.

HERBERT L. MERRICK, 65, inventor and founder of the Merrick Scale Mfg. Co., Passaic, N. J., died Monday, May 2 at his Passaic home. He was a native of Brooklyn and was engaged in engineering capacities in various industries until he formed his own company 30 years ago.

JAMES P. FARRELL, 47, quarry superintendent at Colton, Cal., for the California Portland Cement Co., died April 18 in a hospital at Riverside, Cal., after a short illness. Death was caused by a streptococcic infection which started in the throat, advanced into the middle ear and settled in the brain. He was a native of Independence, Mo., and had just been elected a member of the Colton city council a few days before his death.

JAMES H. LOCKHART, 75, Pittsburgh industrialist, died May 16 after a long illness. He was a director of the Alpha Portland Cement Co.



Foreign Developments

X-Ray Studies on Tricalcium Silicate

A large number of investigations in the field of the reactions in the solid phase, by the authors and by G. Hüttig, have shown that at the beginning of the conversion from one to another crystalline form there almost always forms at first not the well-formed crystals of the end product, but active intermediary products which are distinguished by increased capacity for reaction to hydrous solutions, by strong capacity for adsorption, by increased catalytic capacity as to gas reactions and by other phenomena. Since in the production of cement even before the sintering a number of reactions in the solid phase take place, it is to be expected that the compounds occurring in cement form at first in active form, "active" in this connection signifying in general such states in which the compounds do not yet occur in their characteristic form but in some structure high in energy. It is also to be expected that when such active products occur in cement, they will have considerable effect on the setting process.

Roentgenographic investigations (reported in this article) on $3CaO.SiO_2$ have established principally two varieties of active states which may occur in the formation of this crystal—one, an open structure with less CaO than corresponds to the molecular relation 3:1, and another abnormal crystal formation with $3CaO.Al_2O_3$. These formations must also occur in cement clinker and there influence the setting process. For a crystal with any disturbances or stresses of structure is more strongly exposed to the attack of a solvent material than a perfect crystal. Consequently it not only happens that in the process of burning Portland cement clinker a great deal of alite is formed, and that this forms in extremely small crystals, but also that its crystal structure is defective. The dead burning of cement is thereby made comprehensible. With too long and too high burning the alite crystals become larger and larger and alter more and more to a perfect structure.

The formation of active states in the solid phase is essentially dependent on external influences. Not only variations in temperature, but also, and particularly, small quantities of impurities or admixtures can evoke or reduce them. This furnishes an explanation for the fact that in one firing the specimens with low liter weight showed expansion of structure, but in another firing did not, for this is caused by a lower content of CaO and therefore disappears if the rapidity of impression of CaO in the trisilicate crystal is very rapid. And in fact, speed of reaction and of diffusion in the solid state are very sensitive to impurities.

The work has also shown that the $CaO—Al_2O_3—SiO_2$ diagram may be altered from two directions. For one, the two-component system $CaO—SiO_2$ established by Shephen and Rankin and later revised by Ferguson and Merwin and by Grieg must be improved.—Wilhelm Jander and Joseph Wuhrer in *Zement*, 27:73-76, 86-88, Feb. 10 and 17, 1938.

Question of Hardening of Hydraulic Binders

A review of various studies on the hardening of hydraulic cementing materials indicates that for the hardening of cement it is fundamentally not de-

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THE once necessary evil of using *heavier* pipe than was needed in order to obtain the required *strength*, was wiped out when Taylor Forge pioneered spiral pipe.

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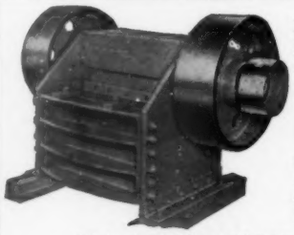

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terminative whether a collodial material or an amicroscopically small crystalline material is present in the mortar bed, but the essential thing is that the material which forms in the mortar bed, in its formation with the taking-up of water, requires so much water that the water added in gauging is removed by incorporation in the mass and the mass dries out; furthermore, that the material which is formed does not have the property of sucking up more water. Cement mortar therefore hardens in an atmosphere saturated with water vapor, in contrast to lime mortar.—V. Rodt in *Tonindustrie-Zeitung,* 62:188-190, Feb. 28, 1938.

Alumina Content and Resistance to Sulphate

Investigations reported in this article lead to the conclusion that in cements of the high-silica type it is the low proportion of alumina which makes these cements so remarkably good in the quality of resistance to the attack of magnesia sulphate waters. The presence of free lime in these cements is not at all prejudicial to their good conservation, thanks to the relatively high purity in which the principal chemical constituent of which they are formed occurs. It is even possible to see that this free lime may even have a beneficial effect on cements stable in the LeChatelier-Anstett test. From the consideration of these facts it is apparent that the theory attributing to the presence of free lime the causes for decomposition of a hydraulic cement in magnesian sulphate waters is not correct.—R. Steinmetz in *Revue des Materiaux de Construction et de Travaux Publics,* No. 340, January, 1938, pp. 1-6.

TRADE NOTES

Contractors Equipment Corp. has been appointed distributor for the complete line of Koehring construction equipment in the Oregon territory. This new corporation is centrally located at 1215 S. E. Grand Avenue in Portland.

The K. B. Noble Co., Hartford, Conn., has been made distributor in the New England states for the new industrial Diesel engines made by the General Motors Corp.

Dempster Bros., makers of the Dempster Dumpster, have opened a Chicago office in Room 904 in the building at 201 N. Wells St.

The Sullivan Machinery Co., manufacturer of drilling equipment and air compressors, is moving its general offices from Chicago to Michigan City, Ind. A sales office will continue to be maintained in Chicago. Plants of the company are located at Michigan City and Claremont, N. H., with additional manufacturing facilities at Dundas, Ont., in Canada, and at Grantham, England.

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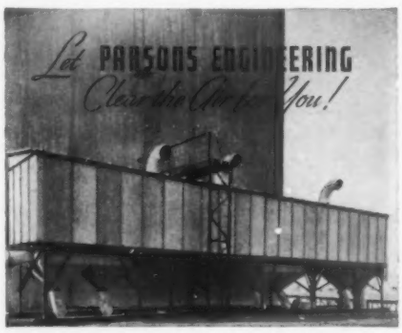

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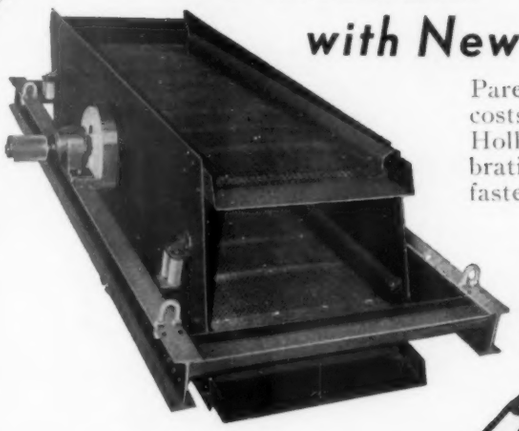

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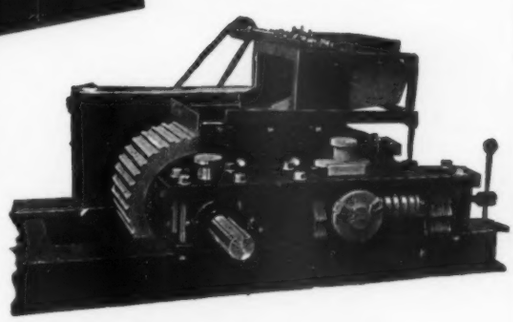

NEW HOLLAND MACHINE CO.
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Occupational Diseases and the Law

Common Law Right

Thomas, Administratrix, v. Parker Rust Proof Co., decided May 4, 1938, by the Michigan Supreme Court. The decision disposes of eight separate cases involving the same defendant, decided in a single opinion upon the record in the *Thomas* case, and reaffirms the court's earlier decision in *Cell v. Yale & Towne Manufacturing Co.,* 281 Mich. 564, that where employer and employee are operating under the provisions of the Michigan Workmen's Compensation Act, damages for an injury to the employee, not compensable under that Act, may not be recovered in an action at law.

The administratrix claimed that decedent, while in the employ of the defendant company, suffered a diseased condition of the lungs, due to the inhalation of dust and fumes during a course of years and known as silicosis or pneumoconiosis, causing his death.

The Court quotes from its decision in the *Cell v. Yale & Towne Manufacturing Co.* case as follows:

"Plaintiff contends that he has not met with an accident, neither is he suffering from an occupational disease but that he has been injured by the negligance of the defendant, and inasmuch as the compensation act affords no remedy, except for accidental injuries, and none for occupational diseases it has not abrogated the common law remedy here invoked. * * *

"Upon review plaintiff admits there is no remedy at law for an occupational disease, strictly as such, but claims that for injuries sustained, without accident, but by reason of the failure of the employer to protect him as an employee, he may maintain this suit."

The Court in that case held: "The relation of master and servant existed. The declaration avers a duty upon the master to provide a vent for the fumes and culpable neglect to do so.

"Plaintiff averred an action governed by the law of master and servant. Such an action cannot be mainatined against an employer operating under the Workmen's Compensation Act."

In the present case, prosecution of the action is held to be barred by Sec. 1 of the Workmen's Compensation Act (Compiled Laws, 1929, Sec. 8407), Sec. 8409 and Sec. 8410. Sec. 8407 takes away from the employer not operating under the Act certain common law defenses, while Sec. 8409 makes the provisions of Sec. 9407 wholly inapplicable to an employer operating under the Compensation Act, and Sec. 8410 expressly limits the employer's liability, where both the employer and employee are operating under the provisions of the Act, by providing that the employer shall not be subject to any other liability whatsoever.

The Court recalls that an employee had no right of action at common law against an employer for injury or death due to an occupational disease (*Adams v. Acme White Lead & Color Works,* 182 Mich. 157-159-162); so, no such right of action was taken away by failure of the Compensation Act to constitute an occupational disease a compensable injury. An occupational disease was not an accidental injury at common law and its inclusion in the Compensation Act would have been an added liability of the employer and, as such, require specific mention or designation. "The Legislature framed the compensation act to take the place of all common law remedies and, as such remedies arose from accidental injuries occasioned by negligence of the employer, the term 'accidental injuries' was employed advisedly."

One of the judges in a dissenting opinion, in which another concurs, thinks, however, that "it was not the intent and purpose of the workmen's compensation act to take away from injured employees rights which they had at common law without substituting a new remedy in the place of their right of recovery. Therefore, the common-law liability of an employer for injuries to the employee arising out of the negligent failure of the employer to furnish a safe place to work,—occupational diseases, not accidental injuries,—remains subject to the rule of the common law."

Knowledge of Injury

Travelers Insurance Co. v. Burden, petition for rehearing denied by the United States Circuit Court of Appeals, Fifth Circuit, February 11, 1938. This case, involving compensation for lead poisoning resulting from the blowing of a cloud of dust into the employee's face, under the Texas law, was brought into court on petition for rehearing on account of the decision of the Texas Supreme Court holding "that the date of the injury and not the subsequent date when incapacity develops, is the correct one from which to reckon the time within which the claim should be filed and notice given." (*Williams v. Safety Casualty Co.,* 102 S.W. (2d) 178.)

The court holds that the present case is distinguished from the *Williams* case in that this is not a case of traumatic injury, the existence of which is apparent, but an injury resulting from the gradual onslaught of lead poisoning, the existence and cause of the injury being unknown until substantially the time when notice was given; that even if the employee's lack of knowledge did not postpone the date from which the statutory limit for notice begins to run, it does constitute good cause for the Accident Board to waive a strict compliance with the notice statute, which is expressly provided for in Art. 8307 (4-a), Rev. Civ. Stats. of Texas. As notice of an injury presupposes knowledge of its existence, a waiver of strict compliance with the notice requirement would be justified in the circumstances. This is a case of ignorance of the existence of the injury, not merely a misjudging of the results of a known injury, nor mere ignorance of the employee's legal rights.

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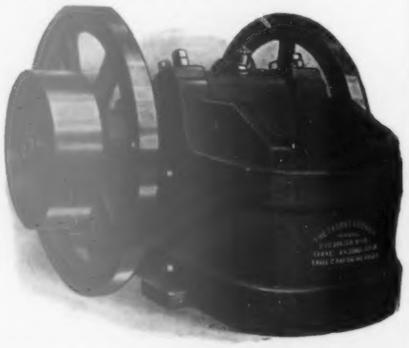

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Traffic News Digest

Legislation

Fourth-Section Revision—At the hearing before the Senate committee on Interstate and Foreign Commerce on the Pettengill Bill for elimination of the long-and-short-haul clause of section 4, only 10 shipper witnesses were produced. This was to shorten the hearing so that time would be given for consideration of the bill by the Senate before adjournment. These witnesses were produced by the National Industrial Traffic League. The 21 standard railway labor organizations filed a memorandum urging that the bill be reported favorable by the Committee. A letter signed by Chester G. Moore, Chairman of the Board of Directors of the Central Motor Freight Assn., addressed to the association members, urged them to write the Senators from Illinois in opposition to this measure stating that if the bill were adopted, it would be possible for the railroads to make a lower rate for a longer haul than for a haul between any two intermediate points, permitting them to decrease rates between points where they have active truck competition while they still have higher rates between less competitive points. The majority report of the Committee favoring passage of the Pettengill Bill was filed with the Senate May 10. A statement filed with the Senate by opponents stated that the bill was opposed by the Interstate Commerce Commission, the Maritime Commission and State Regulatory Commissions, by farm organizations and farmers, shipper groups and individual shippers, labor and competing transportation. The statement further pointed out that passage of the bill would encourage discrimination, impose a costly burden on shippers and would precipitate rate wars and encourage monopoly.

Senators Copeland of New York and Ashurst of Arizona stated in the Senate on May 9 that they would conduct a filibuster against the Pettengill Bill "until the snow flies if necessary."

In filing the majority report Senator Minton of Indiana pointed out that the long-and-short-haul clause of the fourth section was unfair and discriminatory since it applied only to railroads and to no other form of transportation under the law and that with this provision eliminated that other provisions of the Interstate Commerce act as seen from their language and from numerous decisions of the Interstate Commerce Commission and the courts pertaining thereto will afford full, adequate and complete protection to every person, company, firm, locality or any practical description of traffic against any unreasonable or unjustly discriminatory rate, charge, practice or action of any railroad or railroads. The bill provides that the burden of proof to justify a lower rate or charge for a long distance is placed with the rail carriers. In regard to water competition the report says:

"The contention of the water carriers is that the repeal of the long-and-short-haul clause of the fourth section would enable their destruction by the railroads. There can be no doubt that this would be impossible under the law. In the establishment of lower competitive rates to the more distant points the railroads cannot lawfully go lower than necessary to fairly meet competition and enable participation in traffic. If they should undertake to do so, it is clear from decisions of the Interstate Commerce Commission and the courts that this would constitute a violation of section 3 as against intermediate points which could and doubtless would be prevented by the Commission under its suspension and minimum rate making power. The competitive rail rates prior to 1920, when railroads were permitted by the Interstate Commerce Commission to charge less for the longer than for the shorter hauls, have been higher than the rates of the water lines wherever any superiority in rail service over water service has existed which has generally been the case. The transportation charges of water carriers can and will continue to be fixed by them. This bill will only afford the railroads a square deal and an opportunity to fairly compete."

Land-Grant Rate Repeal—Chairman Wheeler of the Senate Interstate Commerce Committee has introduced a bill, No. 3,876, which would provide that the regular commercial rates be charged on transportation by the railroads on all government shipping beginning Jan. 1, 1938. This would eliminate the present arrangement whereby government freight is transported at special rates on account of the land grants made to the railroad many years ago. It is estimated that the reduced government rates for the year 1937 amounted to seven million dollars. The bill was reported favorably by the Committee on April 26th without hearings after being amended to provide that troops and military supplies should move at the land-grant rates. The land-grant rates are 50 per cent. of the commercial rates but this does not mean that the government makes a saving of 50 per cent. on all freight traffic since the special rates only apply via the routes of carriers which were granted land, and most of which are in the west. The adoption of the amendment will probably reduce the estimated additional earnings from one-half to one million dollars. This legislation may result in some loss of traffic to the rails since the higher rates may cause the government to use truck transportation if it is found less expensive. Captain Robert E. Shannon of the War Department gives the following example of the method used in establishing net rates on government traffic.

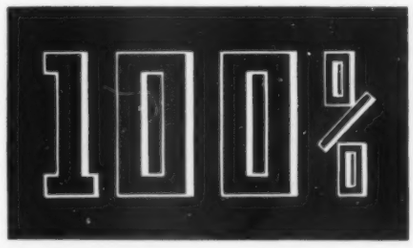
"A shipment of first-class freight moves from Chicago, Ill., to Kansas City, Mo., the commercial rate is 60 c. per cwt. and the net rate is established over the C. B. & Q. R. R. from Chicago to Kansas City. The total distance is 487.76 mi. of which the distance between Palmyra Junction and Cameron Junction, 156.87 mi., is over a 50 per cent. land-grant line. The deduction would, therefore, be $\frac{156.87}{487.76}$ times 50 per cent. or 16.081 per cent. (The deduction is usually expressed in percentage terms for convenience.)"

Motor-Act Revision—The recommendations made by the Commission for revising the motor carrier act have been introduced in Senate bill No. 3,606 which has been reported favorably by the Senate Interstate Commerce Committee. For the most part the bill makes minor changes which will clear up obscure provisions in the act and expedite proceedings before the Commission. It would also give the Commission power to issue a temporary operating authority to a motor freight carrier without hearing or other proceedings. The bill also gives the Commission wider authority in prescribing the use of plates on motor carrier vehicles. An identical bill was introduced in the House under No. H. R. 9,739 which has been referred to a sub committee headed by Representative Sadowski of Michigan.

Postalization of Fares and Rates—Representative Lemke of North Dakota has introduced H. R. 10,570, a bill which would provide for the postalization of transportation rates and also a resolution requiring the Commission to investigate the practicability of postalizing passenger fares. Mr. Lemke recently gave a radio address in which he spoke on the advantages of postalized rates. In the Senate a resolution was offered by Senator Copeland requiring the Commission to investigate the postalization of passenger fares and to report to the Senate not later than Feb. 1, 1939. This resolution was referred to the Interstate Commerce Committee. The plan proposes that passenger fares be made in much the same manner as postal rates. Some propose that one flat rate may be made to appply to all passenger transportation regardless of the distance outside of suburban travel where others propose that the country be divided into zones and fares be made in much the same manner as parcel post rates are now constructed. In offering his resolution, Senator Copeland said:

"The postalized plan provides for uniformity of passenger-rail rates beyond suburban areas, regardless of the length of travel, within each of nine areas to be established by the Interstate Commerce Commission. It sets up a proposal for government cooperation during an experimental period of 3 years. Members of both houses have expressed interest. It is the view of the sponsors that the radically decreased and uniform, distanceless passenger fares will stimulate passenger rail traffic far beyond any other inducement. The sponsors also envision that the value of railroad securities held by insurance companies, banks, and trusts will be adequately safeguarded."

Through Routes—After the Supreme Court of the United States decided that the Commission was without authority to prescribe a through route which would short haul any



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Cincinnati, Ohio

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A Haiss Belt Conveyor

in its class is just as outstanding in quality as a HAISS LOADER.

See Bulletin 1127 for proof of its simple, strong, *High Grade* construction—at a price you can afford. Low receiving end is ideal for unloading hopper-bottom cars.

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Who, for over 40 years, have created and sold none but equipment of demonstrable superiority in design and manufacture.

Bucket Loaders — Clamshell Buckets

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AIR SEPARATORS

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Harrison Square, BOSTON, MASS.

participating carrier the National Industrial Traffic League proposed an amendment to section 15 of the Interstate Commerce Act which would give the Commission authority to prescribe through routes regardless of short hauling any carrier. Senate bill 7,261 which would carry out these provisions passed the Senate at the last session and was sent to the House where it was referred to a sub committee. The sub committee has voted against reporting the bill to the full committee.

Recent I. C. C. Decisions

Lime—In response to fourth section application No. 17,169 carriers party to Peele's I. C. C. No. 2,955 have been authorized to establish rates on common lime including magnesium lime, hydrated, quick or slack, c.l. minimum weight 50,000 lb. from Berwick, La., to destinations in Alabama, Florida, Georgia, Mississippi, North and South Carolina without observing the long and short haul clause of the 4th section, subject to a 50 per cent. circuity limitation. I. C. C., F. S. O. No. 13,100, lime from Berwick, La.

Rail-Motor Purchase—The Commission has denied the application of the Cleveland, Columbus and Cincinnati Highway, Inc., to purchase the operating property and rights of the Reo Transportation Co. which operation is largely in Ohio. The denial was based on the finding that the applicant which was railroad controlled had not submitted sufficient evidence required by section 213 (a) (1) of the motor carrier act. The applicant known as the CCC Highway was owned by the United States Truck Lines, Inc., a holding company which was controlled by another holding company, Standard Car Holding, which in turn was owned by three other holding companies which in turn were controlled by the Erie, Pere Marquette, and Chesepeake & Ohio railroads.

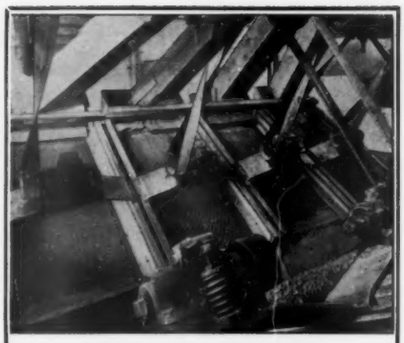
Road-Building Materials—In response to 4th section application No. 17,111 carriers have been authorized to establish and maintain rates on road-building materials from Port Tampa and Tampa, Fla., on coastwise traffic from beyond to destination in Florida without observing the long and short haul clause, subject to the usual 50 and 70 per cent. circuity limitations and to the provision that rates to the higher rated intermediate points should not exceed rates constructed on the same basis as those to more distant points. I. C. C., F. S. O. No. 13,087.

Sand—Finding the rates charged on industrial sand from Selkirk, N Y., to Royersford, Hamburg, and Middletown, Pa., prior to July 1, 1935, not unreasonable the Commission has dismissed complaints in I. C. C. docket No. 27,803, Floyd-Wells Company *v.* N. Y. C., *et al.;* Sub No. 1, Berks Foundry & Mfg. Co. *v.* same; and Sub. No. 2, Wincroft Stove Works *v.* same.

New Complaints Filed

Sand & Gravel—Alleging violation of section 1 reparation is sought on a movement of sand and gravel from Hawarden, Ia., to Dell Rapids, S. D., in a complaint filed by A. R. Morgan, 108 West 35th St., Minneapolis, Minn., in I. C. C. docket No. 28,009, Western Asphalt Paving Corp., Sioux City, Ia. *v.* Milwaukee.

The rate and switching charges on sand and gravel from Attica, Ind., to Champaign, Ill., is alleged unjust, unreasonable, and unprejudicial with the undue preference being for producers of sand, gravel and crushed stone at Kern and Merom, Ind., Mackinaw, Lincoln, Kankakee and Pekin, Ill., and an award of reparation is prayed for in a complaint filed by E. Guy Sutton, Mattoon, Ill., in I. C. C. docket No. 28,018, Neal Gravel Co., Mattoon, Ill., *v.* Wabash.



The User of the eight 1924 model, LEAHY Screens shown above, could tell you how fine screening can be done profitably. Hundreds of other users enjoy the higher screening efficiencies and lower costs guaranteed with Leahy Screens.

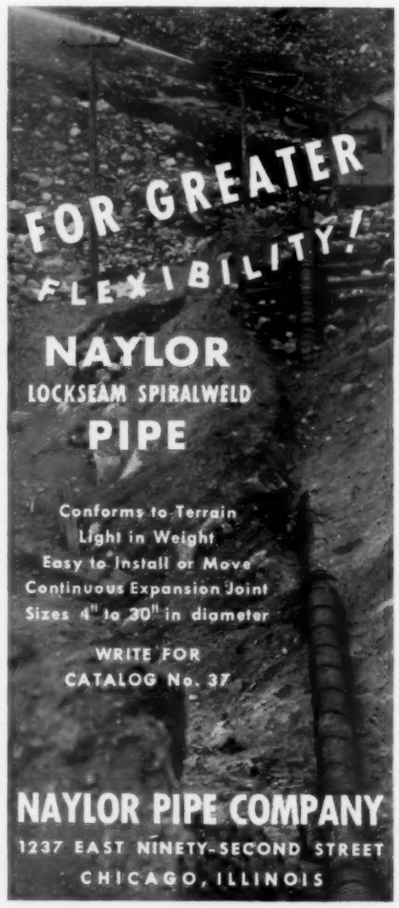
The new Leahy Screen takes an even bigger lead when it comes to screening at fine meshes.

Write for Bulletin

THE ORIGINAL DEISTER CONCENTRATOR COMPANY

INCORPORATED 1906

913 Glasgow Ave. Fort Wayne, Ind.



New Machinery and Supplies

• Oil Refiner

The self-contained oil refiner.

The Precision automatic refiner will re-refine from 30 to 40 gals. of waste lubricating oil a day. A charge of 2½ gal. of oil and 1 to 1½ lb. of filtering compound (a highly refined fullers' earth having an affinity for carbon and inorganic matter) are poured into the upper chamber through the fill cap. The oil is heated to a temperature of 300 to 550 deg. (depending upon the viscosity desired) and agitated by compressed air. The electric heating elements are ample to operate the machine at full capacity, and are thermostatically controlled to cut off at the predetermined temperature as set on the thermostat dial. The extinguishing of the pilot light signals that this point has been reached.

When the oil is ready for filtering, a valve is opened to allow it to pass into the lower chamber, where it is subjected to a pressure of 10 lb. All sludge and solid matter remains in the filter chamber with the filtering compound, leaving clean, pure oil, ready to use.

The process may be repeated again and again. The results will be the same, because the oil itself never wears out.

While the first charge of oil is filtering, a new charge is poured into the upper chamber and the process repeated. Thus the machine holds two separate charges at the same time. After the first charge, the capacity is two charges an hour. The first charge requires about 45 minutes, since the machine is cold and slower to heat.

The Precision refiner is fully automatic in operation. No special skill is required—a man with no previous experience can turn out good oil by following the simple directions furnished with the machine. It is made by the Precision Engineering Co., Kansas City, Mo.

• Core-Drill Bit

The Sullivan Machinery Co., Michigan City, Ind., has released literature descriptive of a revolutionary new type of core-drilling bit known as the Kobelite Korbit. In terms of bit cost per foot of hole drilled, savings of 15 to 20 per cent. are claimed in comparison with any other type of bortz-set core-drill bit. Faster drilling speed and greater footage per bit are also claimed.

Kobelite Korbits consist essentially of a number of bortz-bearing inserts accurately located and firmly brazed into radial slots in the face of the bit blank.

By means of an ingenious patented process, the stone-bearing insert or metal matrix, and the stones, are moulded and integrally bonded together. Even temperature changes can not affect this bond. Because the stones are set in the inserts with mechanical precision and in accordance with a definite field proved pattern and because the inserts are located with close limit gauges, an absolutely uniform contour gauge is achieved which gives maximum cutting speed and insures straighter hole. These outstanding new bits are available in any style and size.

New type of bit for core drilling.

• Hauling Unit

The Hug Co., Highland, Ill., has just completed shipment of four of its large Caterpillar Diesel-Powered "luggers" to the Gulf Oil Corp. for the Meme Grande Oil Co., Venezuela.

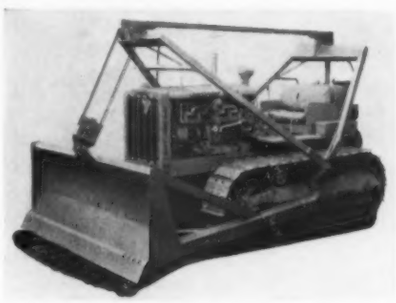
The Model 36 Hug "lugger" is a specially designed heavy-duty dirt and rock-moving unit, equipped with a 10-12 cu. yd. Boulder Dam type body, with twin cylinder hydraulic power hoist.

Diesel-powered Model 36 "lugger."

• Angle-Bulldozer

Built to incorporate the most practical structural features of all previous models, a new type of angledozer and bulldozer, Type C, has been added to the line of R. G. Le Tourneau, Inc., Peoria, Ill. and Stockton, Cal. This new product is for use on Caterpillar D4, D6 and D7 tractors.

Both the angledozer and bulldozer utilize a bowl-and-yoke structure similar to that of the current track type, but the bowl is supported by an overhead A frame rather than by two side arms. Due to its central mounting, this overhead frame distributes the weight of the 'dozer more uniformly over the tractor tracks—thereby reducing tractor wear to a minimum and insuring maximum traction efficiency in any material. Cable life is also lengthened because of fewer sheaves in a more simple arrangement. Operator's vision is virtually unobstructed.



New model angledozer-bulldozer.

• Air-Drill Hose

In Manhattan's Grenadier-G.O.P. air-drill hose the serious disadvantages encountered when oil enters ordinary rubber air hose are said to be overcome. Oil as a solvent causes natural rubber to swell and to deteriorate rapidly, while synthetic rubber will withstand the effects of oil, yet has all the qualities of ordinary rubber. The hose is well constructed with two or three braids of strong long staple

PERFORATED METAL SCREENS
FOR SAND, GRAVEL STONE, ETC.
Manufactured exactly to your specifications.
Any size or style screen, in thickness of steel wanted with any size perforation desired.
We can promptly duplicate your present screens at lowest prices.
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MADDOX
PIT DUMP CAR

Typical unit shown of the complete Maddox equipment installed at the Newberry, Florida, plant of the Newberry Corporation. Plant designed and equipped by Maddox engineers . . . the leading manufacturer in the South for Roll Crushers, Quarry Cars, Revolving Screens, Vibrating Screens, Hoisting Equipment, Dredging Machinery and Log Washers. Write for Bulletin.

MADDOX FOUNDRY AND MACHINE WORKS

Archer - - - - Florida

New Pioneer No. 73 stabilizer plant for mixing aggregates, clay, calcium chloride or salt to produce a stabilized paving mixture. Complete on one truck, it is designed for operating out of stock-piles. The folding delivery conveyor seen at the right delivers the finished product to trucks which transport it to the grade where it is spread, rolled and compacted to set up a firm, dustless thoroughfare.

cotton cord. Between these are placed sheets of live rubber which vulcanization forces into the cord, forming one inseparable unit. This construction, with the addition of a heavy abrasion-resisting cover of black rubber, gives Grenadier hose great strength. The smooth uniform bore of the tube permits a free flow of a large volume of air. The hose is available in all regular sizes from ¼ to 2 in.

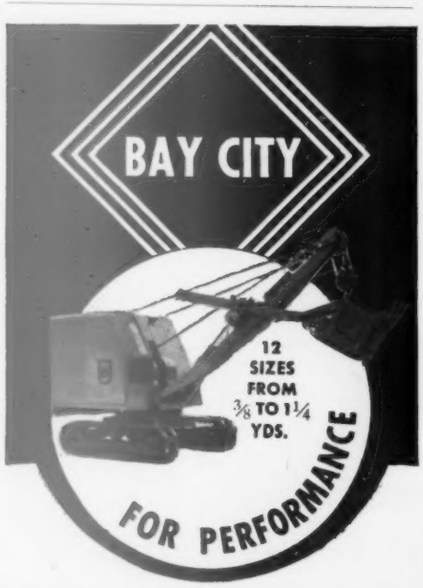
• "Load Lugger"

Users of hauling equipment will be glad to learn about the Brooks Load Lugger. Production of this equipment has been started, after months of designing, experimenting and rigid tests.

Uses for the Load Lugger cover many types of work, including the transfer of stone from quarry to crusher, for hauling concrete aggregates, brick and tile. It offers low-cost service to fertilizer plants, gypsum and other mines. In cities, on busy or narrow streets, the Load Lugger serves remarkably well in sewer excavation work, as well as all other types of public work; in fact, for hauling and transferring any material which is loaded by hand.

Speed and low-cost operation are feature advantages of the Load Lugger. One truck alone can service 5 to 10 bodies, depending upon the material to be loaded and the distance hauled. In one stone quarry, one 1½-ton truck and driver is taking care of seven 1¼-ton buckets, transferring rock an average of 250 cu.yd. from points of loading to crusher. It has replaced four 1½-ton trucks, eliminating the expense of three trucks and drivers, all idle standing time, upkeep and operating expense. Although three truck drivers were

BAY CITY



BAY CITY Shovels, cranes and draglines, available in 12 models ranging from ⅜ to 1¼ yards, both light and heavy duty machines, are noted for highest quality of workmanship, design accessibility, speed, economy, working range and safe load capacity. For more yardage at low cost investigate BAY CITY.

Write for details

BAY CITY SHOVELS, INC.
Cable address "DREDGE"
BAY CITY, MICH.

A "lugger" loaded with stone, ready to be transported.

dropped, nine bucket loaders were added, with production stepped up 50 per cent. and costs dropped materially.

The advantages of the Brooks Load Lugger are many. No counterweight is required in front of the truck or elsewhere. It employs direct drive from a power take-off to the hydraulic pump-hoist assembly and requires no high-pressure hose connections. The lugger has no cables or sheaves—thereby precluding the possibility of expensive replacements and chances of breakage.

The bucket is carried on the truck itself rather than by suspension, and dumps instantly, without leaving the truck, if desired.

• Excavator

A new ¾ cu. yd. shovel weighing 36,000 lb. is announced by the Byers Machine Co., Ravenna, O. It is called Model 83 and is convertible to all boom attachments.

Line and swing speeds have been stepped up to increase the number of digging cycles per minute. More power per pound of weight is employed. Pre-formed rolled steel construction provides strength to safely handle the

This new excavator is characterized by modern lines.

extra power. Lighter overall weight more closely approaches highway load limits, makes moving easier and less expensive and reduces ground bearing pressure. Long boom and dipper sticks increase shovel working ranges. Over-size clutches and brakes make full dippers easy to handle at wide radii.

The Model 83 uses a 72-hp. gas or Diesel power plant. Major shafts are journalled in anti-friction bearings. All gears on the upper deck have machine cut teeth.

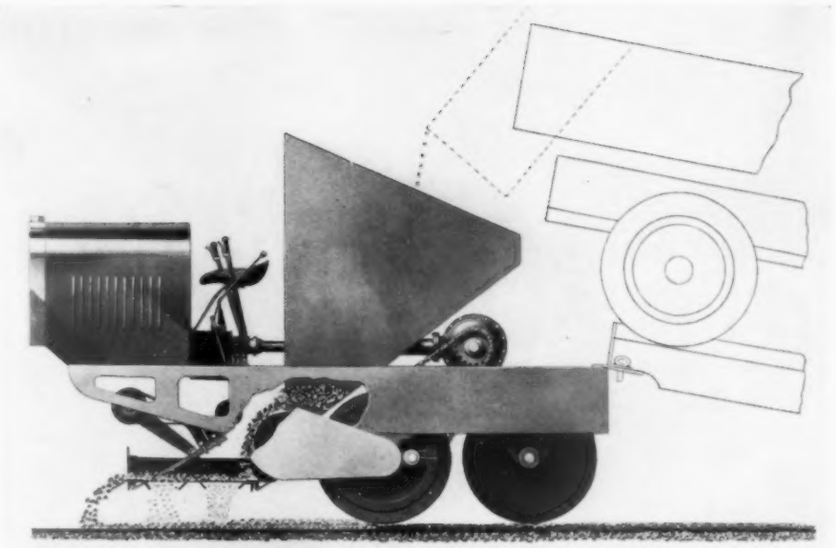
Chain or cable types of shovel crowd are optional. Boom and dipper sticks are of preformed, rolled steel construction the same as the main revolving frame, carbody and crawler side bolsters. The cast manganese alloy dipper front has integral tooth bases.

• Roller-Spreader

The Universal Crusher Co., Cedar Rapids, Ia., has introduced a unique road-surfacing material spreader of entirely new design for seal coating and spreading all types of stabilized road materials.

Known as the Spreaderoller, this new machine segregates the aggregates into coarse material, medium sized material and fines, depositing them in that order on a freshly sprayed bituminous surface and rolling them smooth all in one operation and with one machine.

The Spreaderoller consists of a chassis mounted on three rollers, the third of which is at the back of the machine directly behind



Schematic drawing illustrating the action of the spreader.

the inside edges of the two forward rollers. The two forward rollers are driven and the machine is steered by braking either right or left driven roller.

Mounted on the chassis is an industrial power unit and a hopper with mechanical distributor which feeds the aggregates to a shaker screen.

A portable ramp is towed by the Spreaderoller which permits trucks to back up to and back-dump into the hopper. The machine need be stopped only a matter of seconds for charging the hopper. This method keeps trucks off the fresh bituminous application.

Roads are immediately ready for use and, since the Spreaderoller surfaces any width up to 10 ft. even the narrowest roads need not be closed as traffic can by-pass on the half of the road not being surfaced. Fewer trucks are needed and Spreaderolling eliminates material being wasted on shoulders and in ditches.

Sure...ARMCO supplies Heavy-Wall Pipe

Here's another advantage you gain by using Armco Spiral Welded Pipe. Its wall thicknesses range from 12 gage up to ½-inch. Moreover, you are offered a choice of base metals, including a special steel that outwears ordinary steel from 50 to 200 per cent.

You can obtain this sturdy, easy-handling pipe in diameters from 6 to 36 inches; lengths up to 60 feet—with any type of field joint, including machine contracted ends formed integral with the pipe. Send us your inquiry today for pipe you need to convey sand, gravel or water. The American Rolling Mill Company, Pipe Sales Division, 1761 Curtis Street, Middletown, Ohio, U. S. A.

ARMCO

ARMCO SPIRAL WELDED PIPE

THE BEST BUY **GREDAG** FOR 30 YEARS

The Original Electric Furnace GRAPHITE GREASE

LUBRICATION

THAT CHECKS

DEPRECIATION

For any and all outdoor equipment . . . cheapest insurance against repairs and replacements

Write for Lubrication Manual—52 Pages—Free—"Known the World Over"

THE GREDAG CORP.

NIAGARA FALLS, N. Y.

NO. 9381 TY-ROD

U. S. PATENT NO. 2,024,806 TRADE-MARK REG.

TY-ROD HIGH CAPACITY SCREEN

for DAMP STICKY and FIBROUS materials

TYLER WOVEN WIRE SCREEN CLOTH in All Meshes and All Metals

TYLER-NIAGARA SCREENS

HUM-MER and TYPE 400 SCREENS

SCRUBBING and DRYING MACHINERY

THE W. S. TYLER COMPANY Cleveland, Ohio

● Sand Pump

The new Butler tell-tale sand pump, being marketed by the Pekor Iron Works, Columbus, Ga., has a shell which the manufacturer claims will never wear out. This is because there is no actual contact of the material being pumped with the shell itself, a renewable inner liner being employed.

A line of packing is interposed between the outer periphery of the liner and the inner periphery of the shell. A jet of water, spurting through one of the "tell-tale" portholes, notifies the operator that the time has come to replace the inner lining. No wear ever takes place on the shell.

Pump shell separated showing replaceable liner.

Bearings are of bronze which the maker claims outlast babbitted bearings 5 to 1.

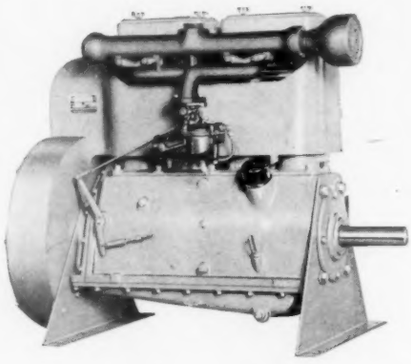
The impeller is designed for high production, its blades being scientifically designed to deliver the greatest possible percentage of solids. Face plates are thick and heavy for long, uninterrupted service.

● Air-Cooled Engine

Because of the continued demand for air-cooled engines of greater horse power, the Wisconsin Motor Corp., Milwaukee, Wis., has added a 4-cyl. air-cooled engine to its line. The addition of this new model now provides a range of air-cooled engine sizes from 1 to 28 hp. single and 4-cyl. models.

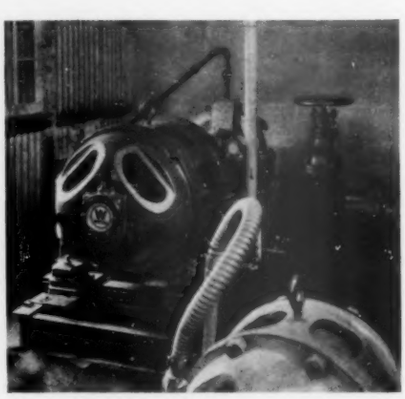
The new model has a 3¼-in. bore by 4-in. stroke and a piston displacement of 132 cu. in. It develops 16 hp. at 1200 r.p.m., with a peak of 28 hp. at 2,400 r.p.m.

Some of the outstanding features of the engine are its very light weight—only 340 lb., complete with accessories, Timken roller bearings on crankshaft front and rear, valve seat inserts, cylinder block and crankcase cast separately for economical servicing, and the absence of any grease cups or oil fittings on the entire engine. All parts are automatically lubricated from the oiling system.



Air-cooled gasoline engine.

This new engine is recommended for all types of equipment in the industrial and agricultural fields where heavy-duty power is required.



Endangered by floodwaters and confronted with the failure of a 100-hp. pump, the Thomasville Stone & Lime Co., Thomasville, Pa., put men on the hand pumps. A Westinghouse motor was ordered at 10 p.m., crated, trucked to Thomasville 225 miles over the Allegheny mountains and placed in service by 10 o'clock the next morning.

Trade Literature

Anchor Gear and Wheel Puller. (Folder) Edelblute Mfg. Co., Reynoldsville, Pa.

A Modern Hand-Rotated 90-Lb. Wet Stop hamer. 6 p. Ingersoll-Rand Co., Phillipsburg N. J.

Flam Concrete Vibrating Machine. 4 p. Blystone Mfg. Co., Cambridge Springs, Pa.

The Stabilizing Effect of Calcium Chloride. 4 p. Calcium Chloride Assn., Detroit, Mich.

Pipe-Line Parts, Fittings and Hydraulic Dredge Accessories. 4 p. Morris Machine Wks., Baldwinsville, N. Y.

Davis Hose Masks. 8 p. Davis Emergency Equipt. Co., New York, N. Y.

Delaval Centrifugal Systems (for purification and reclamation of lubricating oil, etc.). 60 p. DeLaval Separator Co., New York, N. Y.

Thwing Indicating Pyrometers. (Leaflet) Thwing-Albert Instrument Co., Philadelphia, Pa.

Two Stage Air-Cooled Portable Compressors. 24 p. Ingersoll-Rand Co., Phillipsburg, N. J.

Save Blasting . . . Use LeTourneau Rooters. 4 p. R. G. LeTourneau, Inc., Peoria, Ill.

Norblo Screen-Type Dust Arrester. 4 p. Northern Blower Co., Cleveland, O.

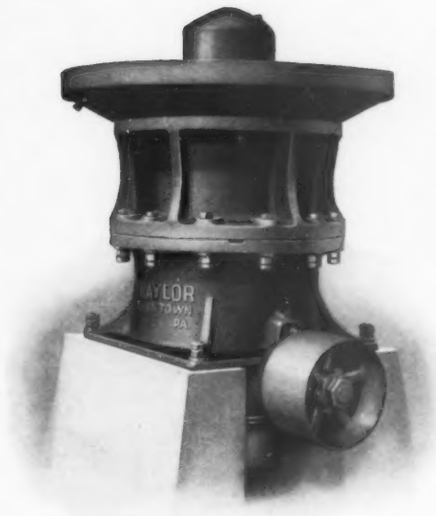
We Raised Our Power Factor, Save $900 a Year. 24 p. Electric Controller & Mfg. Co., Cleveland, O.

Calyx Core Drills. 42 p. Ingersoll-Rand Co., New York, N. Y.

Bailey Boiler Meters. 32 p. Bailey Meter Co., Cleveland, O.

New Horizons in Variable-Speed Transmissions. 12 p. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

"Speedlined" 29-B One Yard Excavator. 32 p. Bucyrus-Erie Co., South Milwaukee, Wis.



Our Type H Blake Jaw Crusher is a worthy companion of the TY—read all about it in our Bulletin 1105.

large output—low unit-power and upkeep costs—that's the story of the

TRAYLOR

TY REDUCTION CRUSHER

"the best crusher we ever owned * *"; "most satisfying performance * *"; "entirely satisfactory in every way * *"; "we are very well pleased with it * *"; "fairly eats up the rock * *"—such are a few of the praises sung by users of the Traylor Type TY Reduction Crusher.

It is all that and more, as we can easily prove, if you'll allow us to discuss it with you. At least, you should have our Bulletin 3012, yours for the asking!

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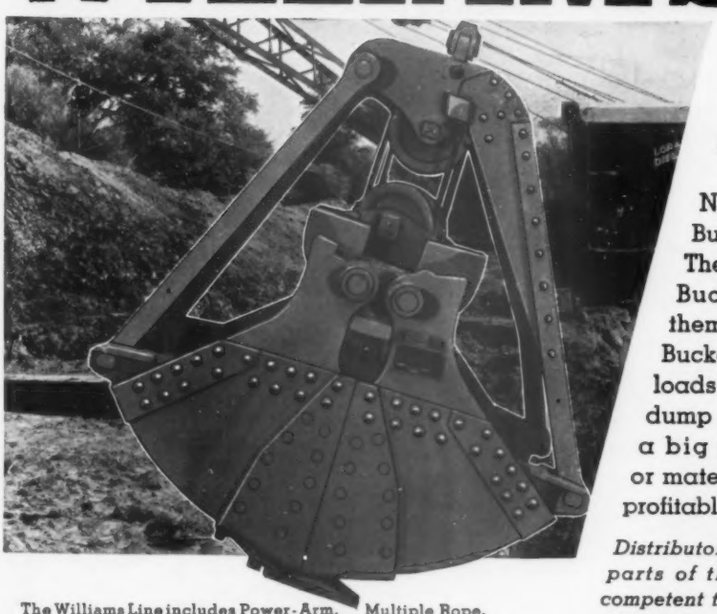
Foreign Sales Agencies: London, Lima, Sao Paulo, Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro
European Works—Usines Carels Freres, Ghent, Belgium

WILLIAMS *Buckets*



The Williams Line includes Power-Arm, Multiple Rope, Power Wheel, Single Line Hook-on and Dragline Bucket.

Built to Last . . . and Move Dirt Fast!

No "dead-head" metal rides in Williams Buckets—you swing pay loads, not inert metal! The special welded construction of Williams Buckets eliminates excess weight—makes them stronger, and more enduring. Williams Buckets are powerful diggers. They bite full loads smoothly and easily, open quickly and dump cleanly. A Williams Bucket can play a big part in making excavating or material handling more profitable.

Distributors located in all parts of the country are competent to render valuable field service.

Tell us the condition, and we'll send you FREE, a special bulletin describing the specific Williams Bucket best fitted to the job.

THE WELLMAN ENGINEERING COMPANY
7000 CENTRAL AVENUE • CLEVELAND, OHIO

built by WELLMAN . . .

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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Hetherington & Berner, Inc.
*Warren Brothers Roads Co.

Agitators, Thickeners and Slurry Mixers
*Hardinge Co., Inc.
*Manitowoc Engineering Works
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Air Compressors (Portable)
*Chicago Pneumatic Tool Co.
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Air Compressors (Stationary)
*Chicago Pneumatic Tool Co.
Fuller Company
*Ingersoll-Rand Co.

Air Filters
*Blaw-Knox Co.
*Dracco Corp.
*Parsons Engineering Corp.
*Western Precipitation Co.

Air Separators
Bradley Pulverizer Co.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co., Inc.
Lime & Hydrate Plants Co.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
Sturtevant Mill Co.
*Williams Patent Crusher & Pulverizer Co.

Alloys (Steel)
Manganese Steel Forge Co.
Stulz-Sickles Co.

Arresters (Lightning)
*Westinghouse Electric & Mfg. Co.

Ash and Refuse Handling Equipment
Allen-Sherman-Hoff Co.
*Haiss Mfg. Co., Geo.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Asphalt Mixing Plants
Hetherington & Berner, Inc.
*Warren Brothers Roads Co.

Automatic Feeders
Bradley Pulverizer Co.
*Fuller Company
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Automatic Weighers
*Blaw-Knox Co.
*Fuller Company
*Jaeger Machine Co.
*Merrick Scale Mfg. Co.

Backfillers
*Bucyrus-Erie Co.
Continental Roll & Steel Fdy. Co.

Balls (Grinding)
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.
*Traylor Engr. & Mfg. Co.

Balls (Tube-Mill, etc.)
*Allis-Chalmers Mfg. Co.
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Barges (Steel)
*Chicago Bridge & Iron Co.
Maddox Foundry & Machine Works
*Manitowoc Engineering Works

Bases (Trolley)
*Westinghouse Electric & Mfg. Co.

Battery Charging Equipment
*Westinghouse Electric & Mfg. Co.

Bearing Metals
*Westinghouse Electric & Mfg. Co.

Bearings (Anti-Friction)
Hetherington & Berner, Inc.
*Link-Belt Co.
Robins Conveying Belt Co.
*Sprout, Waldron & Co.
Timken Roller Bearing Co.

Bearings (Roller)
Timken Roller Bearing Co.

Belt Fasteners
Flexible Steel Lacing Co.

Belt Lacings
Flexible Steel Lacing Co.

Belting
*Cincinnati Rubber Mfg. Co.
*Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

Belting (Conveyor and Elevator)
Goodyear Tire & Rubber Co.

Belting (Multiple V)
Gates Rubber Co.
Goodyear Tire & Rubber Co.

Belts (Fan)
Goodyear Tire & Rubber Co.

Bin Gates
Allen-Sherman-Hoff Co.
*Fuller Company
*Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Fdry. & Machine Works
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.

Bins (Cast Iron)
Allen-Sherman-Hoff Co.

Bins (Steel)
*Chicago Bridge & Iron Co.
*Hendrick Mfg. Co.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Fdry. & Machine Works
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

Blast-Hole Drills (See Drills—Blast-Hole)

Blasting Supplies
*Ensign-Bickford Co.

Block Machines (Concrete)
Dunn Mfg. Co., W. E.
Multiplex Concrete Machinery Co.

Block Machines (Power Press, Concrete)
Dunn Mfg. Co., W. E.
Multiplex Concrete Machinery Co.
R & L Concrete Machinery Co.

Blocks (Pillow)
Maddox Fdry. & Machine Works

Blocks (Sheave)
*Haiss Mfg. Co., Geo.
*Sauerman Bros., Inc.
*Sprout, Waldron & Co.

Bodies (Motor Truck, Concrete Mixing)
*Blaw-Knox Co.
Jaeger Machine Co.

Boots (Rubber)
Goodyear Tire & Rubber Co.

Borings (Core)
Holtman Bros. Drilling Co.
Pennsylvania Drilling Co.

Breakers (Circuit)
*Westinghouse Electric & Mfg. Co.

Brick Machines (Concrete)
Dunn Mfg. Co., W. E.
R & L Concrete Machinery Co.

Brick Manufacturing Equipment
Dunn Mfg. Co., W. E.

Bronze Work (Ornamental)
National Wire Cloth Co.
*Tyler Co., W. S.

Bucket Elevators (See Conveyors and Elevators)

Buckets (Clamshell, Orange-Peel, Etc.)
*Blaw-Knox Co.
*Haiss Mfg. Co., Geo.
*Link-Belt Co.
Owen Bucket Co.
Wellman Engineering Co.

Buckets (Dump)
*Brooks Equip. & Mfg. Co.
*Jaeger Machine Co.
*Dempster Bros. Inc.

Buckets (Dragline—Cableway)
*Bucyrus-Erie Co.
*Link-Belt Co.
*Sauerman Bros., Inc.
Wellman Engineering Co.

Buckets (Elevator and Conveyor)
Cross Engineering Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.

Buggies (Dump)
*Koehring Co.

Bulk-Cement Storage Plants
*Chicago Bridge & Iron Co.
*Sprout, Waldron Co.

Bushings
Maddox Fdry. & Machine Works

Cable (Electric)
Anaconda Wire & Cable Co.

Cableways
Leschen & Sons Rope Co., A.
*Link-Belt Co.
*Roebling's Sons Co., John A.
*Sauerman Bros., Inc.

Calcium Chloride
Calcium Chloride Association

Capacitors
*Westinghouse Electric & Mfg. Co.

Capstans (See Winches and Capstans)

Car Control Systems
*Westinghouse Electric & Mfg. Co.

Car Dumpers
*Link-Belt Co.
Wellman Engineering Co.

Car Pullers
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works

Car Wheels — (See Wheels — Car)

Carriers
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.

Carryalls
*Koehring Co.

Cars (Block, Concrete)
Multiplex Concrete Machinery Co.

Cars (Quarry and Gravel Pit)
Maddox Fdry. & Machine Works

Castings
*Eagle Iron Works
*Hardinge Co., Inc.
Hetherington & Berner, Inc.
Holmes & Bros., Inc., Robt.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Fdry. & Machine Works
McLanahan & Stone Corp.
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

Cement Pumps (See Pumps: Air Pumps; Pumps, Cement Slurry; Pumps, Bulk Cement)

Central Concrete Mixing Plants (Comp.)
*Jaeger Machine Co.
*Sprout, Waldron & Co.

Chain (Dredge and Shovel)
Manganese Steel Forge Co.

Chain Drives
*Jeffrey Mfg. Co.
*Link-Belt Co.

Chain (Elevating and Conveying)
Cross Engineering Co.
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
*Sprout, Waldron & Co.

Chutes and Chute Liners
Cross Engineering Co.
Goodyear Tire & Rubber Co.
*Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Smidth & Co., F. L.
*Sprout, Waldron & Co.

Classifiers
Bradley Pulverizer Co.
*Deister Machine Co.
*Hardinge Co., Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Norberg Mfg. Co.

Cleaners (Oil)
Precision Engineering Co.

Clips (Wire Rope)
Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.

Clutches
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Sprout, Waldron & Co.

Coal-Pulverizing Equipment
*Allis-Chalmers Mfg. Co.
Bradley Pulverizer Co.
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Compressors (See Air Compressors)

Concentrators (Slurry)
*Deister Concentrator Co.

Concrete Breakers (Air)
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.

Concrete Mixers
*Blaw-Knox Co.
*Jaeger Machine Co.
*Koehring Co.

Concrete Slab Raising Equipment (Mud-Jacks)
*Koehring Co.

Condensers
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.
*Westinghouse Electric & Mfg. Co.

Cones (Sand-Washing)
*Chicago Bridge & Iron Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
Smith Engr. Works

Controllers (Electric)
*Westinghouse Electric & Mfg. Co.

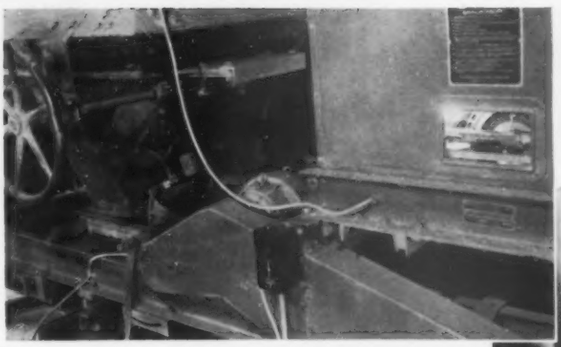
Converters (Electric)
*Westinghouse Electric & Mfg. Co.

Conveyor Belting (See Belting)

Conveyor Idlers and Rolls
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

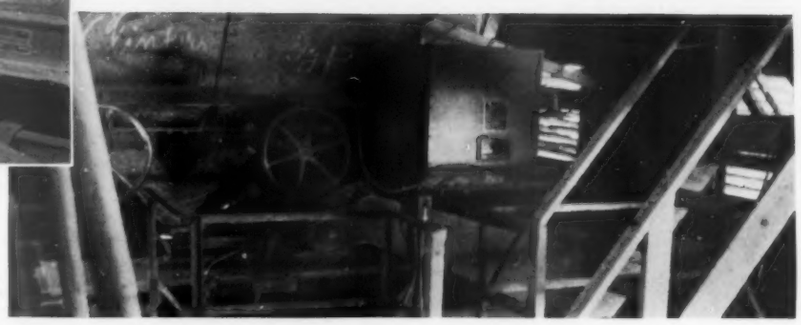
Conveyors and Elevators
Allen-Sherman-Hoff Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.



Two views of the Merrick Weightometer as installed in the Bellingham, Wash., mill of the Olympic Portland Cement Co.

Another Cement Mill Chooses WEIGHTOMETER



The Merrick Feed-O-Weight automatically feeds material by weight, weighing, totaling and registering the material fed. It may be applied to existing belt feeders. Write for complete information on this companion to the Weightometer.

To insure accurate, automatic control of the amount of clinker ground, the Olympic Portland Cement Co. has just installed a Merrick Weightometer (see story in this issue). Because these installations have proved themselves to be 99% accurate or better, day in and day out, year after year, in installations throughout the world, successful operators are standardizing on the Weightometer for accurately registering the weight of bulk materials while "on the move."

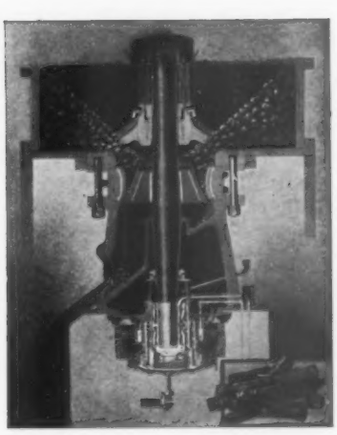
MERRICK SCALE MFG. CO.

PASSAIC NEW JERSEY

MERRICK CONVEYOR WEIGHTOMETER

CRUSHING COSTS COLLAPSE

WHEN USING BALL BEARING GEARLESS CRUSHERS INSTEAD OF POWER EATING GEARED CRUSHERS



The Kennedy Gyratory Crusher uses a Patented Gearless Drive that saves 50% or more power. Having all its dead weight parts supported on Ball Bearings, the total energy is applied to crushing the rock.

The Kennedy Ball Bearing Gearless Crushers are guaranteed to give more tons per hour at less power and maintenance costs than any other make, size for size.

WRITE FOR BULLETIN NO. 35

Sales agents in all principal American cities. . . . Wire us collect for the name of nearest agent. Also manufactured in Canada, Australia, France and England.

KENNEDY-VAN SAUN MFG. & ENG. CORP., 2 PARK AVE., NEW YORK, N. Y.

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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Conveyors (Pneumatic)
*Dracco Corp.
*Fuller Company

Conveyors (Ready-Mixed Concrete)
*Blaw-Knox Co.
*Haiss Mfg. Co., Geo.
*Jaeger Machine Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Coolers (Clinker)
*Allis-Chalmers Mfg. Co.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Coolers (See Kilns and Coolers—Rotary)

Correcting Basins
*Smidth & Co., F. L.

Couplings (Flexible and Shaft)
Erie Pump & Engine Works
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.
*Westinghouse Electric & Mfg. Co.

Couplings (Hose)
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.

Cranes (Crawler and Locomotive)
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Koehring Co.
*Link-Belt Co.
*Manitowoc Engineering Works
Thew Shovel Co

Crusher Hammers
Electric Steel Foundry Co.

Crusher Parts
*American Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Maddox Fdry. & Machine Works
McLanahan and Stone Corp.
*Traylor Engr. & Mfg. Co.

Crushers (Cone)
*Nordberg Mfg. Co.

Crushers (Hammer)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
Bradley Pulverizer Co.
*Brooks Equip. & Mfg. Co.
Electric Steel Foundry Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lime & Hydrate Plants Co.
Sturtevant Mill Co.
*Williams Patent Crusher & Pulverizer Co.

Crushers (Jaw and Gyratory)
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
New Holland Machine Co.
*Nordberg Mfg. Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.

Crushers (Ring)
*American Pulverizer Co.
*Williams Patent Crusher & Pulverizer Co.

Crushers (Roll)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
*Brooks Equip. & Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Fdry. & Machine Works
McLanahan and Stone Corp.
New Holland Machine Co.
*Robins Conveying Belt Co.
*Williams Patent Crusher & Pulverizer Co.

Crushers (Rotary)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
New Holland Machine Co.
*Williams Patent Crusher & Pulverizer Co.

Crushing Rolls
*Allis-Chalmers Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Fdry. & Machine Works
McLanahan and Stone Corp.
New Holland Machine Co.
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Cutter Heads (Dredging)
*Eagle Iron Works
Maddox Fdry. & Machine Works

Diesel Engines (See Engines—Diesel)

Dippers and Teeth (Power Shovel)
*Bucyrus-Erie Co.
*Koehring Co.

Dragline Cableway Excavators
*Bucyrus-Erie Co.
*Link-Belt Co.
*Sauerman Bros., Inc.

Dragline Excavators
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Koehring Co.
*Link-Belt Co.
*Manitowoc Engineering Works
Thew Shovel Co.

Draglines (Walking)
*Bucyrus-Monighan Co.

Dredges
*Bucyrus-Erie Co.
Hetherington & Berner, Inc.
Maddox Fdry. & Machine Works
*Morris Machine Works

Drill Bit Reconditioning
*Bucyrus-Erie Co.

Drill Bits
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.

Drill Sharpening Machinery
*Ingersoll-Rand Co.

Drill Steel
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.

Drilling Accessories
*Bucyrus-Erie Co.
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.
Timken Roller Bearing Co.

Drilling Contractors
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

Drills (Blast-Hole)
*Bucyrus-Erie Co.
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.

Drills (Core)
Hoffman Bros. Drilling Co.
*Ingersoll-Rand Co.
Pennsylvania Drilling Co.

Drills (Diamond)
*Chicago Pneumatic Tool Co.
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

Drills (Hand Hammer)
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.

Drills (Rock)
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.
*Jeffrey Mfg. Co.

Drills (Water Well)
*Bucyrus-Erie Co.

Drills (Well) (See Drills—Blast-Hole)

Drives (Multiple, Belt, Chain, Rope)
*Allis-Chalmers Mfg. Co.
*Westinghouse Electric & Mfg. Co.

Dryers
*Allis-Chalmers Mfg. Co.
*Chicago Bridge & Iron Co.
*Hardinge Co., Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdry. & Mch. Co.
Lime & Hydrate Plants Co.
Maddox Fdry. & Machine Works
McLanahan and Stone Corp.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

Dust Arresters
*Blaw-Knox Co.
*Dracco Corp.
*Parsons Engineering Corp.
*Western Precipitation Corp.

Dust Collecting Systems
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
*Blaw-Knox Co.
*Dracco Corp.
*Parsons Engineering Corp.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Western Precipitation Corp.

Dust Conveying Systems
Allen-Sherman-Hoff Co.
*Blaw-Knox Co.
*Dracco Corp.
*Fuller Company
*Parsons Engineering Corp.
*Western Precipitation Corp.

Dust Filters
*Parsons Engineering Corp.
*Western Precipitation Corp.

Dust Handling Systems (Hydro Vacuum)
Allen-Sherman-Hoff Co.

Dynamite (See Explosives)

Dynamos
*Westinghouse Electric & Mfg. Co.

Electrical Equipment
*Allis-Chalmers Mfg. Co.

Electrodes (Welding)
Stulz-Sickles Co.

Elevator Belting (See Belting)

Elevators (See Conveyors and Elevators)

Eliminators (Soft Stone) (See Soft Stone Eliminators)

Engineers
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
Bradley Pulverizer Co.
Cross Engineering Co.
*Fuller Company
Hetherington & Berner, Inc.
Holmes & Bros., Inc., Robt.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lime & Hydrate Plants Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Smidth & Co., F. L.
*Sprout, Waldron & Co.
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
Wellman Engineering Co.
*Westinghouse Electric & Mfg. Co.

Engine Generator Sets
See Generator Sets (Engine).

Engines (Diesel)
Caterpillar Tractor Co.
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.
*Nordberg Mfg. Co.

Engines (Internal-Combustion)
Caterpillar Tractor Co.
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.
*Nordberg Mfg. Co.

Engines (Steam)
*Ingersoll-Rand Co.
Maddox Fdry. & Machine Works
*Morris Machine Works
*Nordberg Mfg. Co.

Excavating Machinery (See Shovels; Cranes; Buckets, etc.)

Excavators—Shallow Grading (Bucket Elevator Type)
Haiss Mfg. Co., Geo.

Fabricating (Electric Arc and Oxy-Acetylene)
Stulz-Sickles Co.

Fans (Exhaust)
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

Feed Water Heaters
*Westinghouse Electric & Mfg. Co.

Feeders
*Allis-Chalmers Mfg. Co.
Bradley Pulverizer Co.
*Fuller Company
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.
*Traylor Engr. & Mfg. Co.
*Westinghouse Electric & Mfg. Co.

Filters (Oil)
Precision Engineering Co.

Floor Sweeping Systems (Hydro Vacuum)
Allen-Sherman-Hoff Co.

Fuses (Detonating)
*Ensign-Bickford Co.

Fuses (Electrical)
*Westinghouse Electric & Mfg. Co.

Galvanometers
*Westinghouse Electric & Mfg. Co.

Gas Producers
Wellman Engineering Co.

Gaskets
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.

Gasoline Engines (See Engines—Internal-Combustion)

Gates (Bin) (See Bin Gates)

Gates (Clamshell)
*Haiss Mfg. Co., Geo.
*Link-Belt Co.

Gear Motors
*Westinghouse Electric & Mfg. Co.

Gears (Herringbone)
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Sprout, Waldron & Co.
*Westinghouse Electric & Mfg. Co.

Gears and Pinions
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Sprout, Waldron & Co.
*Westinghouse Electric & Mfg. Co.

Gelatin (See Explosives)

Generators (See Motors and Generators)

Generator Sets (Engine)
*Westinghouse Electric & Mfg. Co.

Generator Sets (Motor)
*Westinghouse Electric & Mfg. Co.

Generator Sets (Turbine)
*Westinghouse Electric & Mfg. Co.

Glass Sand Equipment
Lewistown Foundry & Machine Co.

Grab Buckets (See Buckets—Clamshell, Orange - Peel, etc.)

Grapples
Owen Bucket Co.

Grates (Boiler)
Maddox Fdry. & Machine Works

Grating (Steel)
*Blaw-Knox Co.
*Hendrick Mfg. Co.

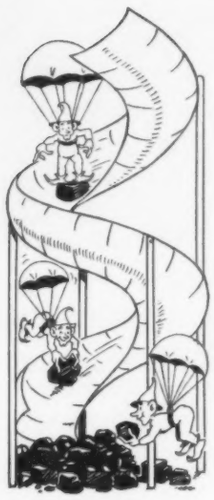
Greases
*Gredag Corp.

Grinding Balls (See Balls, Grinding)

Grizzly Feeders
*Traylor Engr. & Mfg. Co.

Grizzlies
*Allis-Chalmers Mfg. Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.



ROUND AND ROUND IT GOES

NO DEGRADATION

NO BREAKAGE

Handle your sized material with Holmes Lowering Spirals. The gentle sliding descent of materials prevents breakage or degradation—saves you money and eliminates wastage. Operated by gravity these lowering spirals have no power cost.

Tailored to your particular requirements, Holmes Lowering Spirals will give the utmost in efficiency and economy. Let our engineers consult with you.

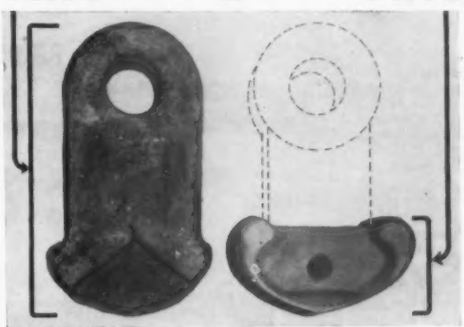
ROBERT HOLMES & BROS.

INCORPORATED

DANVILLE ILLINOIS

DO YOU THROW AWAY

THIS - - - or - - - THIS



55 lbs. - - - or - - - 15 lbs.

when you replace your hammers

Let us tell you the savings effected by using

ESCO RENEWABLE HEAD HAMMERS

These hammers have been used by several leading cement mills on the Pacific Coast for several years with complete success. Write today.

Patented

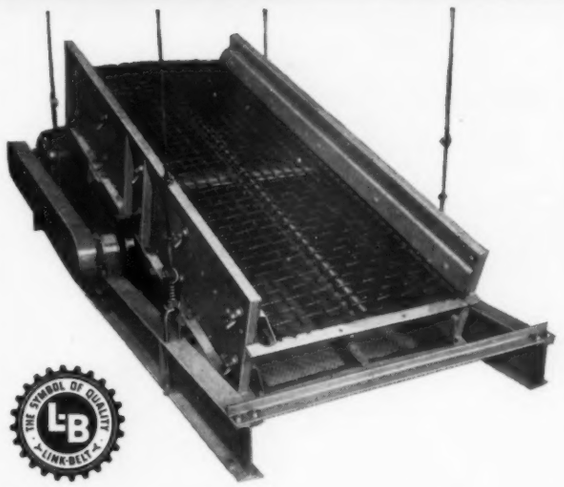
ELECTRIC STEEL FOUNDRY CO.

Portland, Oregon

Seattle. San Francisco, Los Angeles

Denver

LINK-BELT *Vibrating* SCREENS



● Made in two distinct types, for handling sand, gravel, crushed stone, coal, coke, clay, lime, fertilizer, ores, grain, sugar, chemicals, pulpwood chips, etc. Send for Catalog No. 1562. Address Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, or any of our offices, located in principal cities.

72828

KUNTZ SYSTEM

The Kuntz System of Lime Manufacture is the result of more than 30 years of engineering experience in the design, manufacture, construction and operation of lime-burning and lime-hydrating equipment. Complete control insures a uniform-quality product. Minimum power requirements assure lowest cost per ton produced. Ask us to prove it!

LIME & HYDRATE PLANTS CO.

Box 574

York, Pa.

●

for Joining and Repairing

CONVEYOR BELTS

FLEXCO HD

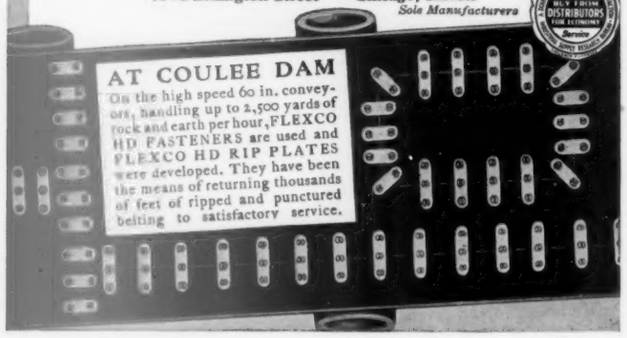
BELT FASTENERS **RIP PLATES**

U. S. Pat. 1,382,799

FLEXCO HD BELT FASTENERS make a tight butt joint of great strength and long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Five sizes in steel and alloys.

FLEXCO HD RIP PLATES are used in repairing rips and patching conveyor belts. The added width gives a desirable long grip on the edges of the rip. Consultation on belt joining and repair invited. Sold through jobbers and belting houses the world over.

FLEXIBLE STEEL LACING CO.
4623 Lexington Street Chicago, Illinois
Sole Manufacturers



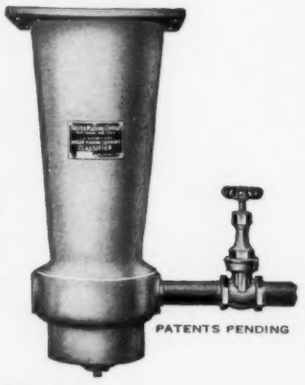
AT COULEE DAM

On the high speed 60 in. conveyors, handling up to 2,500 yards of rock and earth per hour, FLEXCO HD FASTENERS and FLEXCO HD RIP PLATES were developed. They have been the means of returning thousands of feet of ripped and punctured belting to satisfactory service.

COMPOUND FUNNEL CLASSIFIER

For sizing minus 5/16" gravel and sand, and for cleaning it by washing out silt and other light impurities.

Descriptive Bulletin No. 23



PATENTS PENDING

PATENTED AND PATENTS PENDING

PLAT-O

Improved Heavy Duty

VIBRATING SCREEN

Built in all standard sizes—in from one to three decks.

Write for Descriptive Bulletin No. 22

DEISTER MACHINE COMPANY
1933 EAST WAYNE STREET FT. WAYNE, IND.

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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*Kennedy-Van Saun Mfg. and Eng. Corp.
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Maddox Fdry. & Machine Works
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
Smith Engr. Works

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Taylor Forge & Pipe Works

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*Chicago Pneumatic Tool Co.
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*Sauerman Bros., Inc.
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*Cincinnati Rubber Mfg. Co.
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*Ingersoll-Rand Co.

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*Fuller Company

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*Hardinge Co., Inc.
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*Smidth & Co., F. L.

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*Eagle Iron Works
Maddox Fdry. & Machine Works

Ladders (Hydraulic Dredge)
*Eagle Iron Works
Maddox Fdry. & Machine Works

Lights (Electric, Flood)
*Westinghouse Electric & Mfg. Co.

Lime-Handling Equipment
*Chicago Bridge & Iron Co.
*Fuller Company
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Robins Conveying Belt Co.

Lime and Hydrating Plants
*Chicago Bridge & Iron Co.
*Hardinge Co., Inc.
Lime & Hydrate Plants Co.
*Traylor Engr. & Mfg. Co.

Lime Kilns
*Chicago Bridge & Iron Co.
*Hardinge Co., Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lime & Hydrate Plants Co.

Lime Plants (Complete)
Lime & Hydrate Plants Co.

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*Chicago Bridge & Iron Co.

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*Bucyrus-Erie Co.
*Fuller Company
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

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*Westinghouse Electric & Mfg. Co.

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*Westinghouse Electric & Mfg. Co.

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*Westinghouse Electric & Mfg. Co.

Locomotives (Gas-Electric)
*Westinghouse Electric & Mfg. Co.

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*Westinghouse Electric & Mfg. Co.

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*Gredag Corp.

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Manganese Steel Forge Co.

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*Cincinnati Rubber Mfg. Co.
Gates Rubber Co.
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*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Maddox Fdry. & Machine Works
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Mills (Ball, Tube, etc.)
*Allis-Chalmers Mfg. Co.
*Traylor Engr. & Mfg. Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.

Mills (Grinding) (See also Crushers—Hammer)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
Bradley Pulverizer Co.
*Brooks Equip. & Mfg. Co.
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdry. & Mach. Co.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Smidth & Co., F. L.
*Sprout, Waldron & Co.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

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*Allis-Chalmers Mfg. Co.
*Westinghouse Electric & Mfg. Co.

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*Westinghouse Electric & Mfg. Co.

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Multiplex Concrete Machinery Co.
R & L Concrete Machinery Co.

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*Tyler Co., W. S.

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*Deister Concentrator Co.

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Nozzles (Spray)
*Deister Concentrator Co.

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*Gredag Corp.

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Precision Engineering Co.

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*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.

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American Rolling Mill Co.

Pallets
Multiplex Concrete Machinery Co.

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National Wire Cloth Co

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*Jaeger Machine Co.
*Koehring Co.

Perforated Metal Plates
*Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
Cross Engineering Co.
*Hendrick Mfg. Co.
*Sprout, Waldron & Co.

Photo-Electric Cells
*Westinghouse Electric & Mfg. Co.

Pipe (Water, Gas, Low Pressure Steam)
American Rolling Mill Co.
Hetherington & Berner, Inc.

Pipe, Dredge (Floating and Shore)
American Rolling Mill Co.
*Chicago Bridge & Iron Co.
Naylor Pipe Co.
Taylor Forge & Pipe Works

Pipe Flanges
American Rolling Mill Co.
Hetherington & Berner, Inc.
Naylor Pipe Co.
Taylor Forge & Pipe Works

Pipe Fittings
American Rolling Mill Co.
Hetherington & Berner, Inc.

Pipe Forms (Concrete)
Quinn Wire & Iron Works
R & L Concrete Machinery Co.

Pipe Machines (Concrete)
Quinn Wire & Iron Works
R & L Concrete Machinery Co.

Pipe (Spiral)
American Rolling Mill Co.
Naylor Pipe Co.
Taylor Forge & Pipe Co.

Pipe (Welded)
American Rolling Mill Co.
*Chicago Bridge & Iron Co.
Naylor Pipe Co.
Taylor Forge & Pipe Co.

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*Fuller Company
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Portable Crushing and Screening Plants
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
Maddox Fdry. & Machine Works
*Williams Patent Crusher & Pulverizer Co.

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Portable Loaders (See Loaders and Unloaders)

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Power Cables
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Power Tampers (Concrete)
Multiplex Concrete Machinery Co.

Power Units (Internal-Combustion)
Caterpillar Tractor Co.
*Chicago Pneumatic Tool Co.
*Nordberg Mfg. Co.

Precipitators
*Western Precipitation Corp.

Pre-formed Wire Rope
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of The American Chain & Cable Co., Inc.
*Leschen & Sons Rope Co., A.

Press Machines (Hand, Concrete)
Multiplex Concrete Machinery Co.

Presses (Hydraulic)
Maddox Fdry. & Machine Works

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*Blaw-Knox Co.
*Jaeger Machine Co.

Pulleys
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Pulleys (Magnetic)
*Sprout, Waldron & Co.

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*Sprout, Waldron & Co.

Pulverized Fuel Systems
*Hardinge Co., Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.

Pulverizers (See also Crushers, Mills, etc.)
*American Pulverizer Co.
Bradley Pulverizer Co.
*Brooks Equip. & Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co., Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
New Holland Machine Co.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Smidth & Co., F. L.
Sturtevant Mill Co.
Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Pump Valves (See Valves Pump)

Pumps (Air-Lift)
*Chicago Pneumatic Tool Co.
*Fuller Company
*Ingersoll-Rand Co.

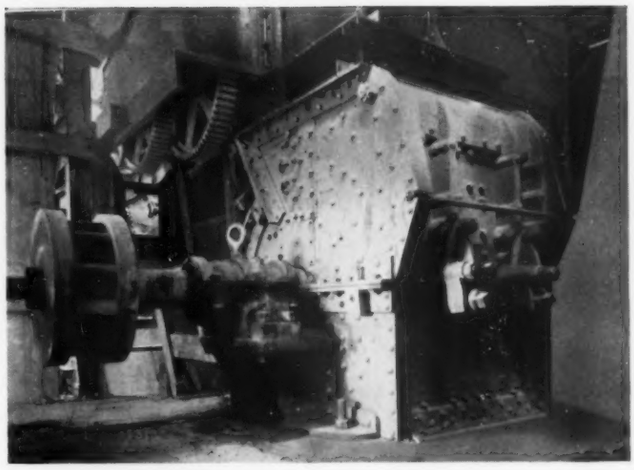
Pumps (Boiler-Feed)
*Westinghouse Electric & Mfg. Co.

Pumps (Bulk Cement)
*Fuller Company

Pumps (Cement Slurry)
Allen-Sherman-Hoff Co.
*Morris Machine Works
*Smidth & Co., F. L.

Pumps (Centrifugal)
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
*Ingersoll-Rand Co.
*Jaeger Machine Co.
Kansas City Hay Press Co.
Maddox Fdry. & Machine Works
*Morris Machine Works
*Westinghouse Electric & Mfg. Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.



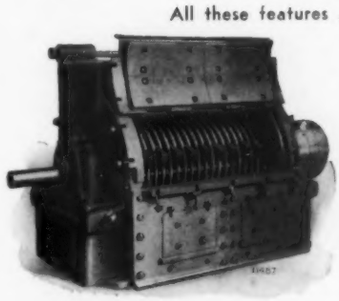
THERE'S A
JEFFREY
Swing Hammer
PULVERIZER
AND
CRUSHER

in the broad Jeffrey line for the accurate reduction of a wide variety of materials in the stone products field. There are many sizes for handling either large or small capacities - - - with machines of medium weight for light work and extra heavily constructed units for heavy work.

Jeffrey swing hammer pulverizers and crushers have the unique feature of reducing through a series of distinct steps, the greater part of the reduction being done in the upper crushing chamber before the material reaches the screen bars in the bottom of the machine.

Another exclusive feature is the heavy renewable liner on the breaker plate, with ledge along lower edge for retaining material being pulverized in suspension. The extra heavy shaft on Jeffrey pulverizers is made of high carbon forged steel, and is fitted with ball bearings.

All these features . . and there are more . . tend to produce a better product and do it with less power. You can save in more ways than one with Jeffrey reduction units.



Tell us the material you want reduced . . what capacity . . size desired . . and from our 44 years' reduction experience and our broad line . . we can readily select a unit to do the job satisfactorily and economically.

The Jeffrey Manufacturing Company
917-99 North Fourth Street, Columbus, Ohio

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified.

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*Allis-Chalmers Mfg. Co.
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*Link-Belt Co.

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*Deister Machine Co.
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*Tyler Co., W. S.

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*Jeffrey Mfg. Co.
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*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Koehring Co.
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*Manitowoc Engineering Works
Thew Shovel Co.

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Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

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*Cincinnati Rubber Mfg. Co..

Speed Reduction Units
*Link-Belt Co.
*Westinghouse Electric & Mfg. Co.

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Holmes & Bros., Inc., Robt.

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*Deister Concentrator Co.

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*Jeffrey Mfg. Co.
*Link-Belt Co.
*Sprout, Waldron & Co.

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*Calcium Chloride Association

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*Jeffrey Mfg. Co.

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Maddox Fdry. & Machine Works

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*Westinghouse Electric & Mfg. Co.

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Manganese Steel Forge Co.

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Manganese Steel Forge Co.

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*Chicago Bridge & Iron Co.
Hetherington & Berner, Inc.
Holmes & Bros., Inc., Robt.
Manganese Steel Forge Co.
*Sprout, Waldron & Co.

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Owen Bucket Co.

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*Chicago Bridge & Iron Co.
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Sauerman Bros., Inc.

Surfacers (Concrete)
*Ingersoll-Rand Co.

Sweeping Systems
Allen-Sherman-Hoff Co.

Switchboards (Electric)
*Westinghouse Electric & Mfg. Co.

Switches (Electric)
*Westinghouse Electric & Mfg. Co.

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*Westinghouse Electric & Mfg. Co.

Tamp Machines (Hand, Concrete)
Multiplex Concrete Machinery Co.

Tanks
Bartlett & Snow Co., C. O.
*Chicago Bridge & Iron Co.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Traylor Engr. & Mfg. Co.

Tanks (Elevated Steel)
*Chicago Bridge & Iron Co.

Tanks (Sand-Settling)
*Chicago Bridge & Iron Co.
Jeffrey Mfg. Co.
*Link-Belt Co.
Smith Engr. Works

Testing Sieves and Shakers
*Hendrick Mfg. Co.
*Tyler Co., W. S.

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Goodyear Tire & Rubber Co.

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*Nordberg Mfg. Co.

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*Allis-Chalmers Mfg. Co.
Caterpillar Tractor Co.

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*Allis-Chalmers Mfg. Co.
*Westinghouse Electric & Mfg. Co.

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Transmission Machinery
*Allis-Chalmers Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Trippers
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Truck Cranes (See Cranes)

Truck Mixers
*Blaw-Knox Co.
*Jaeger Machine Co.

Trucks and Trailers (See Motor Trucks)

Tube-Mills (See Mills—Ball, Tube, etc.)

Tubes (For Tire Casings)
Goodyear Tire & Rubber Co.

Turbines (Steam)
*Westinghouse Electric & Mfg. Co.

Turbines (Water)
*Westinghouse Electric & Mfg. Co.

Underground Loaders
*Allis-Chalmers Mfg. Co.

Unit Heaters
*Westinghouse Electric & Mfg. Co.

Unloaders (Box Car)
*Fuller Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Valves (Pump)
*Cincinnati Rubber Mfg. Co.
Taylor Forge & Pipe Works

Variable Speed Reducers or Transmissions
*Link-Belt Co.

Vibrating Screen Plate
Chicago Perforating Co.
Cross Engineering Co.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

Vibrating Screens (See Screens—Vibrating)

Vibrators
*Ingersoll-Rand Co.
*Tyler Co., W. S.

Wagon Scrapers
Continental Roll & Steel Fdry. Co.

Wagons (Dump)
*Koehring Co.

Washers (Sand, Gravel and Stone)
*Allis-Chalmers Mfg. Co.
*Eagle Iron Works
*Haiss Mfg. Co., Geo.
*Hardinge Co., Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Mach. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
McLanahan and Stone Corp.
*Smidth & Co., F. L.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

Weighing Equipment (Automatic)
*Blaw-Knox Co.
*Fuller Co.
*Jaeger Machine Co.
*Merrick Scale Mfg. Co.

Welding Bars, Wedge and Applicator (Nickel - Manganese Steel)
Stulz-Sickles Co.

Welding and Cutting Equipment
Stulz-Sickles Co.
*Westinghouse Electric & Mfg. Co.

Welding Rods
Bradley Pulverizer Co.
Stulz-Sickles Co.

Welding Service
Stulz-Sickles Co.

Welding Supplies
Manganese Steel Forge Co.
*Roebling's Sons Co., John A.
Stulz-Sickles Co.
*Westinghouse Electric & Mfg. Co.

Well Drills (See Drills—Well)

Wheels (Car)
*Eagle Iron Works

Wheel Rims (See Rims—Wheel)

* See also information in the 1938 Pit and Quarry HANDBOOK.

VANDERWERP RECUPERATOR

Rotary Kilns

The Recuperator is now accepted as the one and only air-quenching type of cooler offering adequate protection against excessive expansion in high-magnesia cements. It insures:

- *Improved Quality of Cement*
- *Better Grindability of Clinker*
- *Maximum Fuel Economy*
- *Highest Efficiency of Heat Recovery*
- *Low Maintenance Cost*

Kiln operators interested in obtaining the maximum benefits from air quenching and heat recovery — with proven equipment — are requested to write, without obligation, for full particulars.

Manitowoc Engineering Works

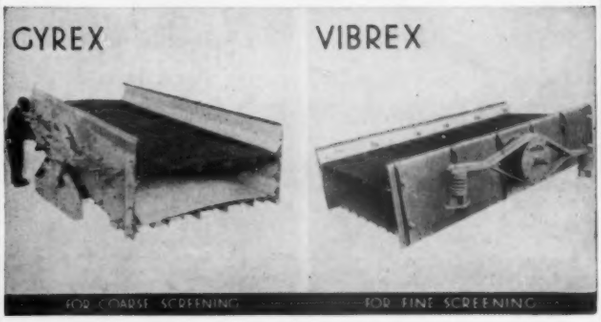
Division of

Manitowoc Ship Building Company

GENERAL OFFICES AND PLANT
Manitowoc, Wisconsin

CHICAGO OFFICE
131 E. River St.

SCREENS



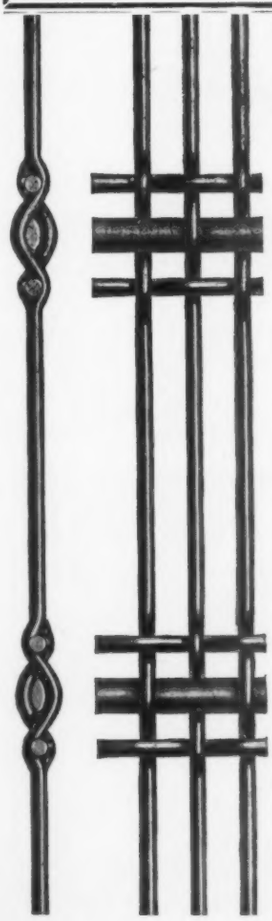
Among the more than three hundred sizes, styles and models of Gyrex and Vibrex Screens designed and built by Robins, there is a screen to exactly suit your work. Ask the Robins representative for his impartial recommendation.

ROBINS CONVEYING BELT CO.
15 Park Row — New York, N. Y.

MATERIAL HANDLING ROBINS EQUIPMENT

ROBINS MAKES belt conveyors, chain conveyors, pivoted bucket conveyors, feeders, bucket elevators and their accessories.

Send for bulletins of interest to you.



STA-TRU

Long-Mesh Woven Wire Screens

made to work under tension and vibration.

The straight stay - bars carry ALL the tension. The crimps in the round wires can not be stretched or broken. The screen can not be caused to sag or split by the pull of the tensioning device.

LUDLOW-SAYLOR WIRE CO. — **ST. LOUIS**

CLEAN AIR

Daily losses of values in dust and fume may mount to thousands—millions—of dollars over long periods. One Cottrell Precipitator installation has recovered more than a million tons of dust in the last 25 years. It is still operating as originally built. Low power requirement. Long life. No maintenance expense. Wet or dry recovery in the condition desired, for re-use or disposal. Efficiency up to 99.99 percent. Cottrell Electrical Precipitators and Multiclones handle ANY type of DUST, FOG, FUME or MIST. Stop dust losses. Stop liability for damages. Stop deterioration of plant and equipment.

Send for Bulletins showing 31 years of successful performance.

WESTERN PRECIPITATION CORPORATION
1016 West 9th St., Los Angeles, California • New York, N. Y.
COTTRELL PRECIPITATORS . . . MULTICLONES . . . SPRAY DRYERS
PIONEER IN DUST AND FUME CONTROL

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Index to Advertisers on Page 96

Winches and Capstans
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

Wire & Cable (Electric)
Anaconda Wire & Cable Co.
*Roebling's Sons Co., John A.
*Westinghouse Electric & Mfg. Co.

Wire Cloth
Cleveland Wire Cloth & Mfg. Co.
Ludlow-Saylor Wire Co.
Manganese Steel Forge Co.
National Wire Cloth Co.
*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
*Tyler Co., W. S.

Wire Rope
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of The American Chain & Cable Co., Inc.
Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.
Union Wire Rope Co.

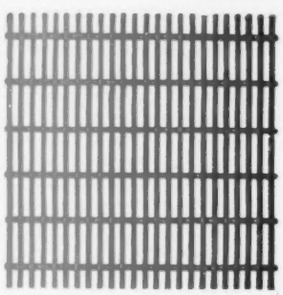
Wire Rope Fittings
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of The American Chain & Cable Co., Inc.
Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.
Union Wire Rope Co.

Wire Rope Slings
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of The American Chain & Cable Co.
Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.
Union Wire Rope Co.

Wire (Welding)
Manganese Steel Forge Co.
*Roebling's Sons Co., John A.
*Westinghouse Electric & Mfg. Co.

Worm Gears (See Gears and Pinions)

* See also information in the 1938 Pit and Quarry HANDBOOK.



Rolled Slot

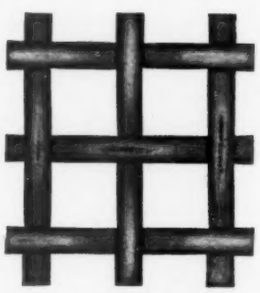
ALLOY No. 2

A super wearing Steel developed to resist the abrasion and vibration of modern screening demands.

"CLEVELAND" SCREENS

A wire cloth of guaranteed accuracy backed by fine workmanship and an effort to satisfy.

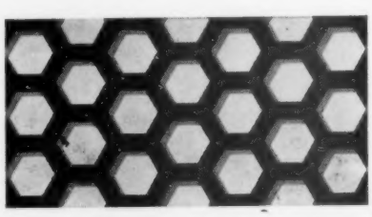
Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



2 Mesh .162 Ga.

THE CLEVELAND WIRE CLOTH & MFG. COMPANY
574 E. 78th St. CLEVELAND, OHIO

CROSS
PERFORATED PLATES
AND SECTIONS



LONGEST WEAR
BEST SIZING
GREATEST CAPACITY

FOR COMPLETE SATISFACTION ON YOUR VIBRATING SCREENS

CROSS HEXCREEN PERFORATION
IS WHAT YOU HAVE BEEN LOOKING FOR
Write for Aggregates screen bulletin
CROSS ENGINEERING CO.
Main Office and Mfg. Plant CARBONDALE, PA.

SYMONS
CRUSHERS • SCREENS

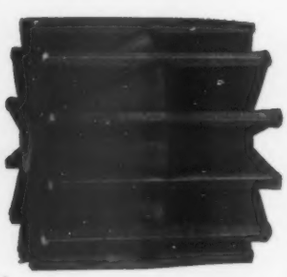
FINER PRODUCT
GREATER CAPACITY
LOWER CRUSHING COST

These advantages have made Symons Cones first among reduction crushers.

SIZES CLOSER
SAVES HEADROOM
ACTION IS POSITIVE

The trend is definitely toward level screening. Again Symons leads the way!

NORDBERG MFG. CO., MILWAUKEE WISCONSIN



CONVEYORS LAST LONGER

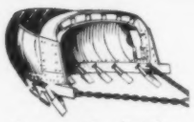
where SPROUT-WALDRON Wing Pulleys are used. The same is true of your Elevator belts.

Material conveyed cannot lodge between belt and pulley to cut your belts.

Interchangeable with standard pulleys.

Write for catalog

SPROUT, WALDRON & CO., INC.
1221 SHERMAN ST., MUNCY, PA.
Elevating, Conveying and Transmission Equipment



Scraper bucket for dragging materials over the ground.

Slackline Cableway bucket for hauling materials to a high dumping point.

SAUERMAN
LONG RANGE MACHINES

Problems of moving gravel, sand, crushed rock, etc., distances of 100 to 1500 ft. are solved most cheaply with Sauerman Drag Scraper or Slackline machines.

There is a double saving when you use a Sauerman machine. You keep down your equipment investment and your daily operating expense is lower than with any other equipment able to dig and haul an equal yardage.

SAUERMAN BROS.
434 S. Clinton St. - - - Chicago

PULVERIZERS

Capacities---1 to 50 Tons per hr.
Finenesses---20 to 350 Mesh.

Air Classifiers

Sizes for any desired capacity.

The MODERN **AIR SEPARATOR**

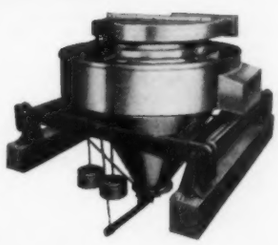
BRADLEY PULVERIZER CO.
ALLENTOWN, PENNA.

Lewistown Foundry Products
ARE
Performance-Tested

BUCKET ELEVATORS
REVOLVING SCREENS
CRUSHERS DRY PANS

Lewistown Foundry & Machine Co.
Lewistown, Pa.

AUTO-VORTEX CLASSIFIER



Where sand is to be recovered and a sharp line of separation is desired, Nordberg offers the Auto-Vortex Classifier in two types, Cone and Bowl. If you have a classification problem, write for further particulars on this automatic and reliable machine.

NORDBERG MFG. CO., MILWAUKEE WISCONSIN

AIR COMPRESSORS
ALL TYPES & SIZES

ROCK DRILLS
SINKERS — DRIFTERS
WAGON DRILLS
DIAMOND DRILLS

CHICAGO PNEUMATIC TOOL COMPANY
6 EAST 44th STREET NEW YORK, N. Y.

CONVEYING SYSTEMS FOR PULVERIZED, FINE, CRUSHED & GRANULAR MATERIALS
FULLER-KINYON — FLUXO — AIRVEYOR
ROTARY FEEDERS - DISCHARGE GATES
FULLER ROTARY COMPRESSORS AND VACUUM PUMPS
AUTOMATIC BATCH WEIGHERS
BIN SIGNALS

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA
Chicago: Marquette Bldg. San Francisco: Chancery Bldg.

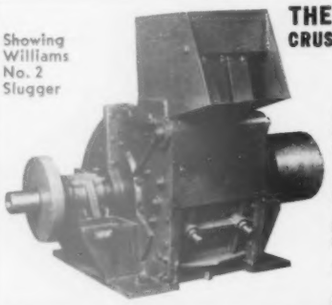
LIGHTNING PUMPS
Heavy-Duty (Ball-Bearing) Sand and Gravel

High efficiency — low operating cost—precision workmanship — wear-resisting, non-heating bearings even when operated under extremely high heads. WRITE

KANSAS CITY HAY PRESS CO.
KANSAS CITY, . . . MO.

ROUND
SQUARE
SQUAROUND*
HEXAGON
PERFORATED PLATE
of every description
for maximum productiveness from your vibrating screens.
*Reg. U.S. Pat. Off.

HENDRICK MANUFACTURING CO.
39 Dundaff Street, Carbondale, Pa.
Sales Offices in Principal Cities. Please Consult Telephone Directory



THE WILLIAMS "SLUGGER" CRUSHER *for* MAKING 1¼", ¾" OR AGSTONE HANDLES LARGE STONE

Rows of heavy, free swinging, fast revolving hammers, crush the material by impact until of proper size to pass through the gates. By reducing large rock to 1¼", ¾" or agricultural size in one operation, the "Slugger" has enabled operators to produce these sizes at a very low cost per ton and with small investment.

WILLIAMS PATENT CRUSHER AND PULVERIZER COMPANY
802 St. Louis Ave. - St. Louis, Mo.

Williams
PATENT CRUSHERS GRINDERS SHREDDERS

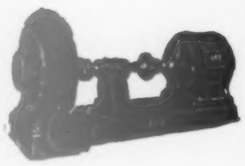
SECO

The only mechanical screen with positive, controlled, vibrating motion.

SCREEN EQUIPMENT CO.
9 LaFayette Ave. Buffalo, N. Y.

ERIE
EFFICIENCY ECONOMY

SAND PUMPS



Their record of 48 years of satisfaction under the hardest conditions of pumping service outweighs all arguments. You can rely on ERIE Pumps for the profitable production of sand and gravel. Start your next dredging job with the advantages that go with ERIE Pumps.

Send for Catalog

ERIE PUMP & ENGINE WORKS
153 GLENWOOD AVE. MEDINA, N. Y.

RECLAIM....
Jaw Plates, Gyratory and Roll Crushers, Shovel Teeth, Etc.
with

MANGANAL

11 to 13½% Nickel Manganese Steel

WELDING ELECTRODES, WEDGE and APPLICATOR BARS

STULZ-SICKLES CO. *Sole Producers* 134-142 Lafayette St., Newark, N. J.

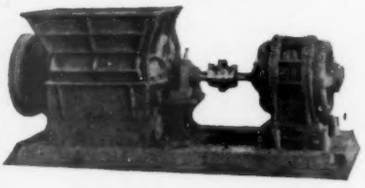
ROI-MAN

Roi-Man Rolled, True (11% to 14%) Manganese Steel has practically double the strength and abrasion resistance of cast manganese steel, ten times the "effective strength" of mild steel and three and a half times that of heat treated nickel steel. Send for this 32 page catalog No. 3R. No obligation.

MANGANESE STEEL FORGE CO. • Castor Ave. & Allen St. • PHILADELPHIA

Specify AMERICAN for every crushing job

You will be sure of greater tonnage of uniform products at lower cost and long, trouble-free service. Every part is carefully selected and tested to assure maximum endurance and quality. AMERICAN Features: Manganese lined crushing chamber; cast steel adjustable platen; heavy alloy steel shaft; SKF roller bearings.



Write for complete details

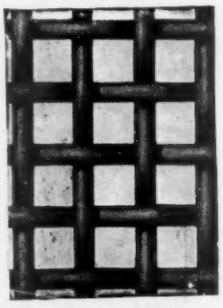
AMERICAN PULVERIZER COMPANY
1289 MACKLIND AVE. ST. LOUIS, MO.

HYDROSEAL
MAXIMIX RUBBER PROTECTION
DREDGE PUMPS

See our advertisement on Inside Front Cover of Last Month's Issue

The ALLEN-SHERMAN-HOFF CO.
223 S. 15th Street Philadelphia

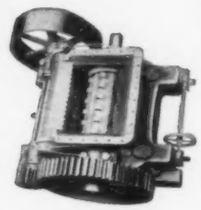
FIVE STAR FEATURES
of Nat-aloy Wire Cloth



- ★ Wears five to ten times as long as cloth made of ordinary steel
- ★ Withstands vibration without crystallization
- ★ Super-tough to resist abrasion
- ★ Maintains accuracy throughout life of screen
- ★ Economical in price and serviceability

Attractive Prices
Immediate Shipments from Stock

NATIONAL WIRE CLOTH CO., INC.
St. Paul, Minn. Write for new catalog No. 36.



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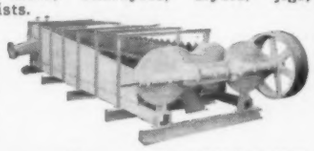
CRUSHERS

Single and double roll and jaw crushers, hammer mills, super dry pans—steel log washers and scrubbers, sand drags, revolving and vibrating screens, elevators, conveyors, dryers, jigs, hoists.

SCREENS

Complete portable, semi-portable and stationary crushing, screening and washing plants for different capacities of any materials.



McLanahan & Stone Corp. *Established 1835* HOLLIDAYSBURG, PENNSYLVANIA

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CENTRIFUGAL PUMPS • DREDGES • STEAM ENGINES

For abrasive mixtures, corrosive liquids, or clear water. Any capacity, head, or method of drive.

For sand and gravel production, water supply reservoirs, filling in, or waterways improvements.

Vertical reciprocating type, single and double cylinders, compound and triple expansion, 3 to 1000 hp.

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MORRIS MACHINE WORKS
Baldwinsville, N. Y.

DRAGPEB LINERS

(Patented)

Special mixture of white iron, uniformly hard throughout. Held in place by neat portland cement, no bolts or wedges required. Shape retained during entire life in mill.

For

PULVERIZING MILLS

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F. L. SMIDTH & CO.

225 Broadway NEW YORK, N. Y.

SAVE 32c TO 62c PER GALLON BY RE-REFINING YOUR OIL

The PRECISION Automatic Oil Refiner re-fines used crankcase oil at an average cost of 2c a quart.

Produces triple refined lubricating oil with all the original characteristics and qualities of new oil.

- Requires less than 30 minutes' attention in 8 hours' operation.
- PRECISION recovers up to 90% at 10% of cost of new oil.
- Automatic electric operation. Self contained.
- Capacity: refines 30 to 40 gallons of waste oil to original grade, quality and color in 8 hours.

SIMPLE - FOOLPROOF - AUTOMATIC - CLEAN

18 of the nation's leading railroads, the largest utilities, bus companies and fleet owners re-refine their waste oil. THERE IS A REASON. . . .

HERE IS THE FIRST MACHINE THAT ACTUALLY REFINES DIESEL AND GASOLINE ENGINE DRAININGS OR ANY WASTE OILS AT A PRICE WITHIN THE REACH OF EVERY OIL USER.

WRITE US FOR COMPLETE INFORMATION

PRECISION ENGINEERING CO.
4301 MAIN KANSAS CITY, MO.

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FOR SALE

Assets of the bankrupt Marianna Lime Products Company plant installed 1928 to 1932 but little used and equipment is now in virtually new condition. Everything will positively be sacrificed for **quick sale.**

No. 8 Williams Jumbo Hammer Mill 56x60" with extra set new hammer.
5—Ocala Knob Roll Crushers 24x36' to 30x54' (three of them never used).
3 ft. x 16 ft. Allis-Chalmers Revolving Screen (new).
1—1½ yard Loraine (Thew) combination Dragline and Shovel with Atlas Imperial full Diesel equipped with 1¾ yard dipper and drag line bucket. This machine has seen only a few months of actual service and could be described as a new or demonstrator's rig.

⅞ Yard Bucyrus Erie Steam Shovel, good operating condition.
120 H.P. Fairbanks-Morse full Diesel Engine, 2-cylinder.
240 H.P. Fairbanks-Morse full Diesel Engine, 4-cylinder.
(Both in excellent condition.)
Several Hoisting Engines.
3—Fairbanks-Morse 125 H.P. slip ring Motors, 2200 volt, 3 phase, 60 cycle, 700 R.P.M., with drum controls, etc.
1 to 12 Yard 2-way Dump Cars.

Also:
Sullivan Drill Sharpener.
Ten tons new ⅞" hollow hex drill steel.
Jackhammers, Drifters, etc.
Three miles 56 lb. rails.
Five miles 80 lb. rails.
Large lot troughing idlers and belt conveyors.
Three Sullivan gas-portable 140 ft. Air Compressors (actual delivery).
Two Sullivan gas-portable 210 ft. Air Compressors (actual delivery).
1000 ft. 36" 6 ply 32 oz. rubber conveyor belt, bought new 1937 and never taken from spools.

370 ft. 30" conveyor belt.
270 ft. 24" conveyor belt.
160 ft. 18" conveyor belt.
Car load cable ⅝ to 1½" new and used.

W. M. SMITH & COMPANY
45th to 48th Sts., First Ave., No. BIRMINGHAM, ALABAMA

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Blaw-Knox 6 yd. Agitator Body—Rebuilt	$1750.00
Blaw-Knox 4 yd. Truck Mixer Body—Rebuilt	2000.00
P. & H. ⅝ yd. Gas Shovel	2250.00
Schramm 260' Compressor and Cleveland Wagon Drill (used two months)	3200.00
Jaeger 1½ yd. Truck Mixer mounted on Stewart Truck—New 1937	2200.00

SERVICE SUPPLY CORPORATION
20th & Venango Sts.
Philadelphia, Pennsylvania

We
- Sell
- Buy
- Rent
- Repair
- Exchange
- All Makes
- and Sizes

GREGORY HI-GRADE-REBUILT

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Electric Motors, Pumps, Air Compressors Big Bargains. All Standard Makes.

•

Always Dependable Economical

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Money-Back Guarantee

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GREGORY ELEC. CO.
1605 S. Wolcott Ave. Chicago
Formerly Lincoln St.

FOR SALE

Locomotive—American, 40 Ton, Standard Gauge, 4 Wheel, Saddle Tank, Nat. Board Boiler, Overhauled, First Class Condition.

Crane—Ohio 18½ ton capacity, 8 Wheel Steam Locomotive Crane, 40' Boom.

Bucyrus—Caterpillar Mounting for Railroad Type Shovel.

Marion—Model 61 Steam Shovel Boom.

Bucket—Hayward 1 cu. yd. capacity, Class E Ore Bowl, Manganese Lips, Overhauled First Class Condition.

Compressor—Sullivan Practically New, Two Stage, Air Cooled, Portable, Class WK 60 Capacity 160 cu. ft. Powered with Buda 4 cylinder gasoline motor.

E. E. FORT
1119 S. 56th St. PHILADELPHIA, PA.

LOCOMOTIVES

85 Ton Baldwin 8-wheel switcher with separate tender, 21x28" cylinders.
85 Ton Porter 6-wheel switcher with separate tender, 22x26" cylinders, superheated, A.S.M.E. boiler.
72 Ton American 6-wheel switcher with separate tender, 20x26" cylinders.
60 Ton Baldwin 6-wheel switcher with separate tender, 19x26" cylinders.
55 Ton Baldwin 6-wheel switcher with separate tender, 18x24" cylinders, A.S.M.E. boiler.
50 Ton Baldwin 6-wheel switcher with separate tender, 17x24" cylinders, A.S.M.E. boiler. Four Duplicates.
40 Ton Baldwin 4-wheel switcher with separate tender, 15x24" cylinders.

Complete stock list on request.

BIRMINGHAM RAIL & LOCOMOTIVE COMPANY
Birmingham Alabama

REBUILT—FOR RENT—SALE

2—C.P. 105—2 stage, air cooled, Portable Compressors "Demonstrator" Models.
1—1½ Yd. Rex Truck Mixer—1937.
2—I.R. No. FM-2 Wagon Drills.
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2 yd. Northwest Diesel Shovel.

JAW CRUSHERS

10x8, 13x7½, 14x7, 15x9, 15x10, 16x9, 16x12, 16x10, 18x11, 20x8, 20x6, 20x12, 20x11, 26x12, 30x15, 30x13, 36x30, 36x18, 36x14, 36x9, 36x6, 38x18, 36x10, 36x24, 42x9, 48x36, 60x42, 84x66, 36x16 and 9x36.
12x26 Champion, Screen & Elevator.

CONE & GYRATORY CRUSHERS

Nos. 24, 37 and 49 Kennedy Gearless.
18", 24", 30" and 36" Symons Disc.
4—10 TZ Traylor 4 ft. Gyratory.
4—Nos. 5, 3 & 6 Austin Gyratory.
36 in. & 10 in. Superior McCullys.
2 Taylor T-12 Bulldog Gyratory.
No. 8 Telsmith 18x75 Gyratory.
No. 5 Telsmith 10x96 Gyratory.
No. 6 BH Traylor Fine Reduction.
17 Gates K—Nos. 3, 4, 5, 6, 7½, 8 & 9½.
2 Ft. Symons Cone Crusher.
10 Inch Austin Model 105.

CLAM SHELL BUCKETS

¾ yd. Cap. Williams Hercules Digger.
¾ yd. Cap. Hayward Material Handling.
2 yd. Owens Material Handling.

CONVEYOR & ELEVATOR PARTS

Elevator Belt: 300 ft. 20 in., 400 ft. 18 in.
Conveyor Belt: 1750 ft. 60 in., 1200 ft. 30 in., 728 ft. 24 in., 320 ft. 20 in., 718 ft. 16 in.
Idlers & Head & Tails: 18—20—24—30 & 36".

DUMP CARS

46—Koppel 1½ yd. 24 and 30 ga., V-Shape.
15—2 yd., 3 yd., 4 yd. 36" G.

STEEL DERRICKS

10 ton American 90 ft. Boom, Guy.
15 ton Clyde 100 ft. Boom, Stiff Leg.

HOISTING ENGINES

17 Steam 7x10, 8¼x10 and 10x12.
8 Electric 20, 35, 50, 60 & 100 H.P.

SAND PLANT EQUIPMENT

6'x8' Allen Cone Settling Tanks.
Tyler Niagara 20 in. x 4 ft. Gyratory Scrubber.
Nelson Gas Caterpillar Loader.

LOCOMOTIVES

5—Whitcomb 6, 10, and 14 ton Std. Ga.
8—Plymouth & Vulcan 3 to 14 T., 2 & 3 ft. Ga.

DRILLS

4—SANDERSONS 14 & LOOMIS 44.
7—Ingersoll-Rand Wagon Drills.

MISCELLANEOUS

9x16 Portable Crushing Plant with bin.
Rotary Dryers: 8'0"x84 ft., 6'0"x50 ft., 5'8"x60 ft., 4'0"x30 ft., 3'6"x24 ft., 3'0"x20 ft.
125 ton Fairbanks R.R. Scale—50 ft.
5 ft. x 12 ft. Rod Mill & 30" Griffing Mill.
8'x6' KVS & 5'x22" Hardinge Ball Mill.
2 Type B Fuller Kinyon Cement Pumps.
30—1½ & 2 yd. Steel Skip Boxes.

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BUCYRUS-ERIE Model D-2 Crawler Type Crane and Dragline; ATLAS DIESEL 4-cyl. Engine — 40 ft. Boom—1¼ yard capacity.
P&H Model 300 Crawler ½ yard Shovel; Waukesha Gas Motor.
KOEHRING No. 1 Crawler Type Crane. 40 ft. Boom.
McMYLER 35-ton Type J Locomotive Crane; 50' Boom; Air Brakes; Double Drums.
KOEHRING 27-E Paver No. 12797.
FOOTE 14-E Paver No. 3270.
CATERPILLAR Model 75 Diesel Tractor (2). REBUILT.
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AMERICAN 40 ton 4 Wheel Saddle Tank Type Locomotive.
PORTER 42 ton 4 Wheel Saddle Tank Type Locomotive.
WESTERN 12 Yard Air Operated Dump Cars (10).
I-R 310 cu. ft. Portable Air Compressor on 4 Steel Wheels.
LEROI 160 cu. ft. Portable Air Compressor on 4 Steel Wheels.
WILLIAMS ¾ & 1 yd. Clamshell Buckets.
PAGE ½ yd. Dragline Bucket.
LIDGERWOOD 30 h.p.; DD. Hoist.
ERIE B-2 Crawler Type Steam Shovel; ⅞ yd. Dipper.

Write for Complete List

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GOOD USED EQUIPMENT

SELECTED SPECIALS

10—Jaw Crushers: 15x24", 15x36" Farrel; 18x30" Allis-Chalmers; 18x36", 24x36" Farrel; 24x36" Allis-Chalmers; 30x60" Traylor; 30x42" Buchanan; 36x42" Traylor; 42x60" Farrel. Also all smaller sizes.
8—Vibrating Screens: 3x6' Huron; 3x6', 4x6' Niagara; 4x8' Allis-Chalmers. All double deck.
9—Tyler Hummer Screens: Types 31, 33, 37, 39, 60.
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1—Schaeffer Poidometer, size 20"x4'6". Complete.
1—13x8x8 Penna. De2 Air Compressor.
1—4" Fuller-Kinyon Type B Dust Pump.
1—12"x15' Jeffrey Apron Conveyor.

Above with 25 cy. Motors, sold with or without motors.

9—Single Roll Crushers: 24x24" Link-Belt; 18", 24", 36x36" Jeffrey; 18x16", 21x40", 21x50" Penna.
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1—36x36" 4XC Gruendler Hammer Mill, roller bearings. Also other types and sizes.

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Blaw-Knox 51 tons, two compts., weigh batchers.
Blaw-Knox 72 tons, two compts., volume batchers.
Fuller 155 bbls. cement, electric weigh batchers.

CRUSHERS

Jaw—6x12, 9x16, 10x16, 10x20, 13x30, 24x36, 48x36.
Gyratory—No. 5 McCully, No. 37 Kennedy Van Saun.

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Troughing rollers and return idlers, 16", 18", 20", 24", 30", 36".
Conveyor belt, 18", 20", 24", 30", 36".
Head and tail pulleys with take ups in any size.
Brand new 24" belt conveyor, steel frame, 65' complete.
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P&H Model 600 crane, 1 yd.
Osgood "Conqueror" crane and shovel, 1 yd.
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P&H Model 400 crane and shovel, ¾ yd.
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Browning truckcrane.

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Gas locomotives from 2½ to 35 tons, 24", 36" std. ga.
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Dual Pumpcrete with 420 ft. of 8" pipe line.
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12 ton Vulcan saddle tank locomotive; 36" ga.; new in 1932; code boiler.
7 ton Plymouth gas locomotive; standard ga.
American Hoist & Derrick Co.'s 3 drum hoist and swinger; 80 HP. A.C. motor.
600 ft. Worthington two stage air compressor; feather valve.
574 ft. Chicago single stage compressor; 14"x14"; plate valve.
350 ft. Gardiner-Denver single stage compressor; 11"x12"; plate valve.
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12" Gould; fig. 3030; 5,000 gal. at 41'.
8" Gould; fig. 3030; 2,000 gal. at 25'.
5" Cameron; 1,200 gal. at 100'.
3" Cameron; fig. 3HV; 650 gal. at 203'.
5" Cameron; 650 gal. at 75'.
All motors with above are 3 phase, 60 cycle, 440 volts.

C. G. WYATT MACHINERY
Princess & Wildwood Aves. CAMDEN, N. J.

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1—Russell Grader, 10' Blade.
1—Link-Belt K-30 Trench Hoe, 45' Boom.
1—Link-Belt K-44 shovel 50' boom, fairleads.
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2—C. P. Compressors, 500 cu. ft., 100 h.p. motor.
2—Worthington Compressors, 621 cu. ft., 75 h.p. mtr.
1—Monarch 75 Caterpillar with bulldozer.
1—Sullivan 310' portable compressor.
1—Ingersoll-Rand pavement breaker.
6—Easton 4 yd. all steel 36" Ga. cars.
4000' of 9" x 9" road forms.
1—Ransome 27 E Paver.
2—No. 116 Chicago Pneumatic Paving Breakers.
2—1 yd. Insley bottom dump concrete buckets.
1—Schramm No. 120 Compressor.
1—1 yd. Owen Bucket.
1—1 yd. Kiesler rehandling bucket.
1—¾ yd. Browning clamshell bucket.
1—¾ yd. Blaw-Knox bucket.
1—Le Courtney 6" Cent. Pump, 40 h.p. motors.
1—Morris 8" dredge pump, 150 h.p. G.E. motor.
1—Morris 10" cent. pump, 2250 GPM at 130' head.
2—Goulds 12" cent. pump, 50 h.p. G.E. motor.
1—Thompson 6" self-priming pump, Waukesha motor.
2—Gardner Denver Sheeting Hammers.
2—Humdinger 6" self-priming pumps, gas motor.
1—Humdinger 4" self-priming pump.
1—Humdinger 2" self-priming pump.
1—Domestic double diaphragm pump, gas motor.
1—G.E. motor, 200 h.p. slipring.
2—No. 9 B 3 McKiernan-Terry Hammers.
3—No. 5 McKiernan-Terry Hammers.
3—No. 7 McKiernan-Terry Hammers.

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1—75 D Lorain Shovel 1½ yard, Gasoline—1936 MODEL.
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1—PLYMOUTH LOCOMOTIVE, 12 Ton, Std. Gauge, Gasoline, Electric Starter & Lights, M. C. B. Couplers.
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1—INGERSOLL-RAND, Portable Gasoline driven Air Compressor—2 STAGE 210 cubic foot actual capacity.
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Tel. Eve. 6363

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REDUC. TYPE: 6, 10 & 18" Super. McCully. 2', 3' & 4' Symons Cone. 7" Newhouse, etc.
ROLLS: Allis-C. 36x16, 40x15, & 54x24. Jeff. 30x30.
HAMMERMILLS: Williams Nos. 3, 4, 5 & 9. Others.
MILLS: Kennedy Ball 4x6, 5x6 & 5x8. Kent 34x7". 48" Fuller-Lehigh. 5'x22' Bonnot and others.

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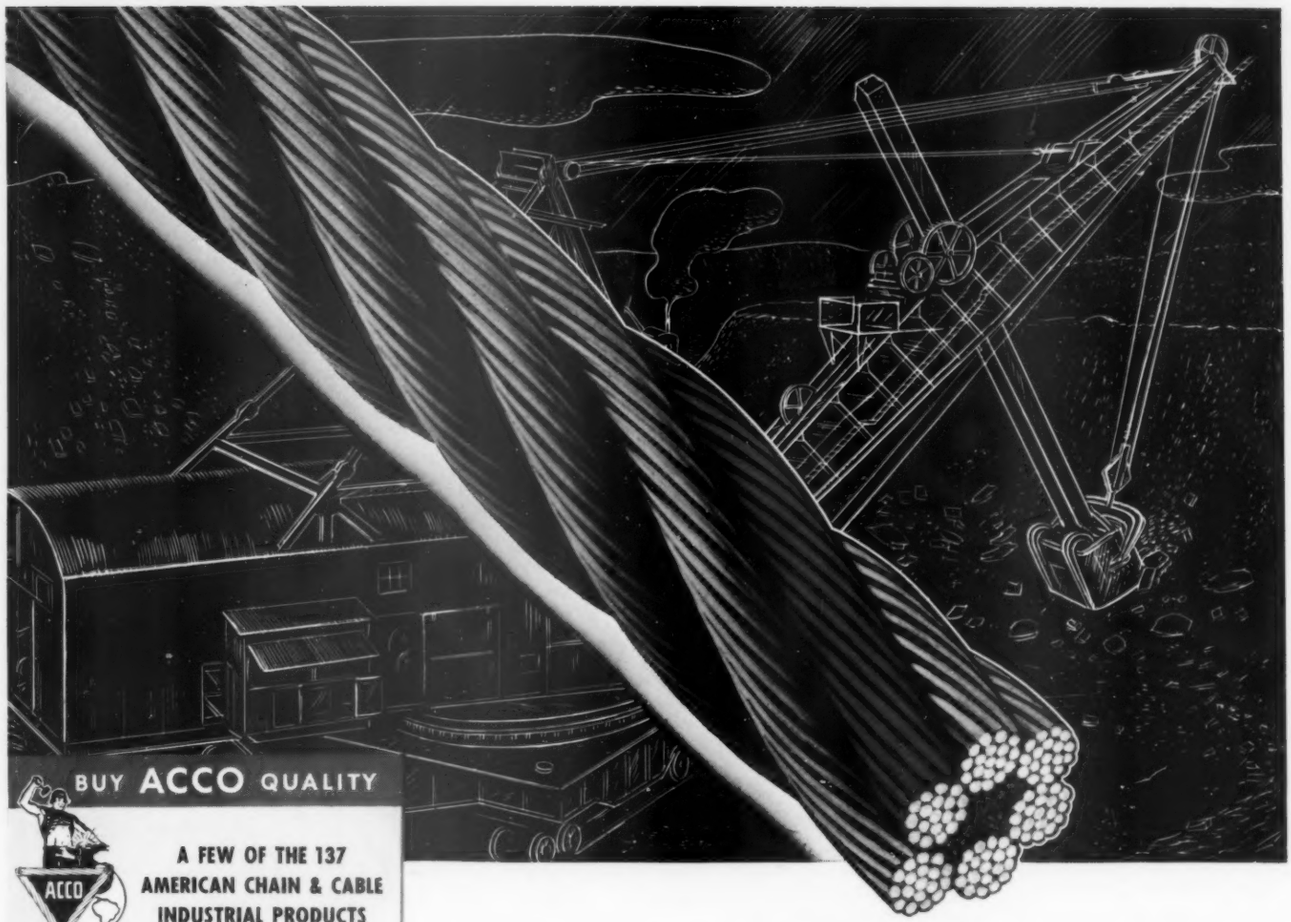

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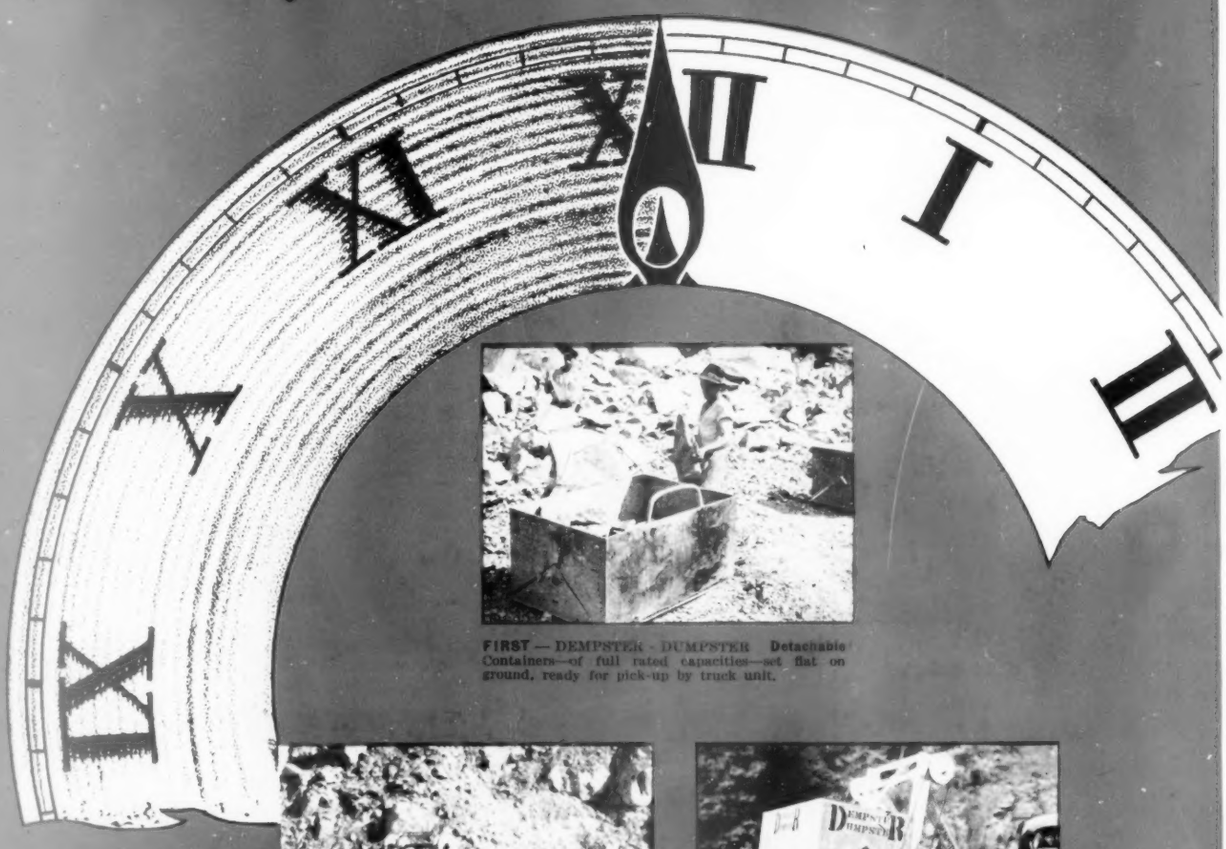

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